

# GRAIN INSPECTION HANDBOOK

## BOOK II, CHAPTER 1

### GENERAL INFORMATION

CHAPTER 1

GENERAL INFORMATION

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## 1.1 STANDARD ABBREVIATIONS

|   |      |  |      |
|---|------|--|------|
| Admixture                               | adm  | Erucic acid  | erc  |
| Amber Durum wheat                       | adu  | Extra heavy  | ehvy |
| Animal Filth                            | anfl | Fine foreign material                                    | fine |
| Angoumois moths                         | moth | Flaxseed   | flax |
| Badly stained                           | bads | Flint  | flin |
| Badly weathered                         | badw | Frost-damaged kernels                                    | fdk  |
| Barley                                  | bly  | Flint and Dent   | flad |
| Bird excreta                            | brdx | Foreign material   | fm   |
| Bleached                                | blch | Foreign material other than rye                          | fmor |
| Blight                                  | blit | Foreign material other than wheat                        | fmow |
| Blue aleurone                           | blal | Foreign material other than wheat or rye                 | fmwr |
| Blue barley                             | blb  | Garlic bulblets  | garb |
| Blue Malting barley                     | blmb | Garlicky   | gar  |
| Bottom not sampled                      | bns  | Glucosinolates   | gluc |
| Bright                                  | brit | Grain  | gr   |
| Broken corn                             | bc   | Handpicked   | hp   |
| Broken corn and foreign material        | bcfm | Handpicked foreign material                              | hpfm |
| Broken glass                            | glas | Hard Amber Durum wheat                                   | hadu |
| Broken kernels                          | bn   | Hard kernels   | hard |
| Broken kernels and foreign material     | bnfm | Hard Red Spring wheat                                    | hrs  |
| Canola                                  | k    | Hard Red Winter wheat                                    | hrw  |
| Castor beans                            | cstb | Hard and Vitreous Kernels of Amber Color                 | hvac |
| Choice                                  | ch   | Hard White wheat   | hdwh |
| Class                                   | cl   | Heat-damaged kernels                                     | ht   |
| Coarse                                  | crse | Heating  | htg  |
| Cockleburs                              | cbur | Heavy  | hvy  |
| Commercially objectionable foreign odor | cofo | Inconspicuous admixture                                  | iadm |
| Contrasting classes                     | ccl  | Insect-damaged kernels                                   | idk  |
| Conspicuous admixture                   | cadm | Infested   | inf  |
| Contrasting lentils                     | clen | Injured-by-frost   | ibf  |
| Corn                                    | c    | Injured-by-heat  | ibht |
| Crotalaria                              | crot | Injured-by-mold  | ibm  |
| Cultivated sunflower seed               | csf  | Injured-by-sprout  | ibs  |
| Damaged kernels                         | dk   | Large stones, etc.                                       | lgst |
| Damaged kernels (total)                 | dkt  | Light garlicky   | lgar |
| Damaged seeds (total)                   | dst  | Light smutty   | lsm  |
| Dark, Hard, and Vitreous                | dhv  | Limed  | lime |
| Dark Northern Spring wheat              | dns  | Machine separated broken kernels and<br>foreign material | msfm |
| Defects (total)                         | def  | Malting barley   | mb   |
| Dehulled                                | dh   | Materially weathered                                     | mwth |
| Dent                                    | dent | Mechanically separated dockage                           | mdkg |
| Diatomaceous earth                      | diat | Mixed  | x    |
| Distinctly discolored                   | disc | Mixed corn   | xc   |
| Distinctly green kernels                | dgk  | Mixed grain  | xgr  |
| Distinctly low quality                  | dlq  | Mixed sorghum  | xs   |
| Dockage                                 | dkg  | Mixed soybeans   | xsb  |
| Durum wheat                             | du   | Mixed wheat  | xwht |
| Dyed                                    | dyed | Moisture   | m    |
| Ergoty                                  | erg  |  |      |

|  |      |                           |      |
|--|------|---------------------------|------|
| Mold-damaged kernels                         | mdk  | Soybeans                  | sb   |
| Musty  | must | Soybeans of other colors  | sboc |
| Northern Spring wheat                        | ns   | Splits                    | spl  |
| Not standardized grain                       | nsg  | Stained                   | stnd |
| Oats   | o    | Stinkbug damaged          | skd  |
| Odor   | odor | Stones                    | ston |
| Oil  | oil  | Stress cracks             | sc   |
| Other classes                                | ocl  | Subclass                  | scl  |
| Other colors                                 | ocol | Suitable malting type     | smt  |
| Other damaged kernels                        | odk  | Sulfured                  | sulf |
| Other grains                                 | og   | Sunflower seed            | sf   |
| Other live insects injurious to stored grain | oli  | Tannin sorghum            | tans |
| Other types                                  | ot   | Test weight               | tw   |
| Other White wheat                            | owh  | Thin                      | thin |
| Plump  | pl   | Total other material      | tom  |
| Protein                                      | prot | Treated                   | tret |
| Purple mottled or stained                    | pms  | Triticale                 | trit |
| Red Spring wheat                             | rs   | Two-rowed barley          | trb  |
| Rodent excreta                               | rodx | Two-rowed malting barley  | trmb |
| Rye  | rye  | Unclassed wheat           | uncl |
| Sample grade                                 | sg   | Unknown foreign substance | fsub |
| Sclerotinia                                  | sct  | Unsuitable malting type   | umt  |
| Scoured                                      | scor | Washed                    | wash |
| Shrunken and broken kernels                  | shbn | Waxy                      | waxy |
| Similar seeds                                | ss   | Weevils (live)            | lw   |
| Six-rowed barley                             | srb  | Western White wheat       | wwh  |
| Six-rowed malting barley                     | srmb | Wheat                     | wht  |
| Six-rowed blue malting barley                | srbm | Wheat of other classes    | wocl |
| Slightly weathered                           | slw  | White aleurone            | whal |
| Skinned and broken kernels                   | skbn | White Club wheat          | whcb |
| Smut balls                                   | sbal | White corn                | whc  |
| Smutty                                       | smut | White sorghum             | whs  |
| Soft Red Winter wheat                        | srw  | White wheat               | ww   |
| Soft White wheat                             | swh  | Wild buckwheat            | wb   |
| Sorghum                                      | s    | Wild brome grass seed     | wbg  |
| Sound barley                                 | sbly | Wild oats                 | wo   |
| Sound oats                                   | so   | Yellow corn               | yc   |
| Sour   | sour | Yellow soybeans           | ysb  |

**NOTE: Abbreviations may be expressed in upper or lower case**

## 1.2 VISUAL GRADING AIDS

- a. General. The visual grading aids system assists inspectors in making subjective grading decisions. This system consists of visual reference images (VRI) and interpretive line prints. Reference is made to visual grading aids throughout this book.
- b. Visual Reference Images. The visual grading aids system represents the foundation for the national inspection system's subjective quality control program, providing an effective management tool for aligning inspectors and assisting them in making proper and consistent subjective grading decisions. The system consists of a series of commodity specific VRI and descriptive text which, with regular use, controls and diminishes the impact of ordinary perceptual differences. Reference to the VRI is made throughout this handbook.
- c. Interpretive Line Prints. Interpretive line prints (ILP) are used as an aid in making subjective grade determinations on general appearance. A special sample box is used to compare the grain being graded with the ILP. To compare the sample with the ILP, place the 5 x 7-inch photographic print in one side of the box and the grain in the opposite side. This allows for the comparison of the grain and the ILP under similar conditions. On the reverse side of each print is an explanation of the condition illustrated on the photograph and procedures for use of the photograph and box. ILS and ILP are available for viewing at FGIS field offices.

The Seedburo Equipment Company is responsible for the production and distribution of ILS, ILP, Slide Viewers, and Interpretive Line Slide Test Strips. Direct all correspondence and orders concerning these items to:

Seedburo Equipment Company  
1022 W. Jackson Boulevard  
Chicago, IL 60607  
Telephone: (Business) - (312) 738-3700  
(Orders) - 1-800-284-5779

- d. Miscellaneous Aids. Inspectors may use a magnifying glass or similar device for visual identification of small objects.

## VISUAL REFERENCE IMAGES

|                      |   |                        |  |
|----------------------|---|------------------------|--|
| <b><u>BARLEY</u></b> |   | <b><u>FLAXSEED</u></b> |  |
| B-1.0                | Blight damage                             | F-1.0                  | Damaged Flaxseed (Bee's wings)           |
| B-1.1                | Mold damage                               | F-2.0                  | Damaged-by-heat                          |
| B-3.0                | Injured-by-frost                          | F-3.0                  | Heat damage                              |
| B-3.1                | Frost damage                              |                        |  |
| B-4.0                | Germ damage (discolored and/or mold)      |                        | <b><u>OATS</u></b>                       |
| B-5.0                | Injured-by-heat                           | O-1.0                  | Badly ground and/or weather damage       |
| B-5.1                | Heat damage                               | O-1.1                  | Weather damaged (Stained)                |
| B-6.0                | Weevil or insect bored                    | O-2.0                  | Germ Damage (Sick and/or mold)           |
| B-7.0                | Injured-by-mold                           | O-2.1                  | Mold damage                              |
| B-8.0                | Sprout damage                             | O-3.0                  | Heat damage                              |
| (B) OF-2.1           | Skinned and broken                        | O-4.0                  | Insect damage                            |
| (B) OF-2.3           | (A) Two-rowed, (B) Six-rowed              | O-5.0                  | Sprout damage                            |
| (B) OF-2.4           | Injured-by-sprout                         |                        |  |
|                      | <b><u>CANOLA</u></b>                      |                        | <b><u>RYE</u></b>                        |
| Canola-1.0           | Distinctly green                          | RY-1.0                 | Germ damage (Sick and/or mold)           |
| Canola-2.0           | Heat damage                               | RY-3.0                 | Sprout damage                            |
| Canola-3.0           | Other damage (A)Rimed, (B) (Frost)        | RY-3.1                 | Exposed germ in sound rye (not sprout)   |
| Canola-4.0           | Sprout damage (A) Damage, (B) Not damage  | RY-3.2                 | (A) Insect chewed, (B) Sprout sockets    |
|                      |   | RY-4.0                 | Weevil or insect bored                   |
|                      |   | RY-5.0                 | Other damage                             |
|                      | <b><u>CORN</u></b>                        |                        | <b><u>SORGHUM</u></b>                    |
| C-1.0                | Blue-eye mold                             | S-1.1                  | Germ Damage (Bleach method)              |
| C-1.1                | Purple plumule                            | S-2.0                  | Ground and/or weather damage             |
| C-2.0                | Cob rot                                   | S-3.0                  | Heat damage                              |
| C-3.0                | Drier damage                              | S-4.0                  | Insect bored damage                      |
| C-4.0                | Germ damage                               | S-5.0                  | Mold damage                              |
| C-4.2                | Not germ damage                           | S-5.1                  | Mold damage (Internal mold)              |
| C-5.0                | Heat damage (Drier)                       | S-6.0                  | Sprout damage                            |
| C-5.1                | Heat damage (White)                       | S-7.0                  | Split germ (Sound kernels)               |
| C-5.2                | Heat damage (Yellow)                      | S-8.0                  | Purple pigment damage                    |
| C-6.0                | Insect damage                             | S-9.0                  | Tannin sorghum (Bleached)                |
| C-7.0                | Mold damage                               | (S) OF-16.0            | Non-grain sorghum                        |
| C-7.1                | Not damage (Dirt)                         | (S) OF-33.0            | White sorghum                            |
| C-7.2                | Mold damage (Pink Epicoccum)              |                        |  |
| C-8.0                | Silk cut                                  |                        |  |
| C-9.0                | Sprout damage                             |                        | <b><u>SOYBEANS</u></b>                   |
| C-10.0               | Surface mold (Blight)                     | SB-1.0                 | Badly ground and/or weather damage       |
| C-11.0               | Surface mold (More than slight)           | SB-1.1                 | Weather damage (Gray/black)              |
| (C) OF-7.1           | Mixed Corn (More than slight tinge-straw) | SB-2.0                 | Damaged by heat                          |
| (C) OF-7.2           | Mixed Corn (White-capped Yellow Corn)     | SB-3.0                 | Green damage                             |
| (C) OF-7.3           | Flint and Dent corn                       | SB-3.2                 | Frost damage (Waxy)                      |
| (C) OF-7.4           | Sweet corn and popcorn (BCFM)             | SB-5.0                 | Heat damage (Materially damaged/heating) |
| (C) OF-7.5           | Corn of other colors                      | SB-6.0                 | Immature (Wafer)                         |
| (C) OF-7.7           | Mixed corn (More than slight tinge-pink)  | SB-7.0                 | Insect bored kernels                     |
| (C) OF-7.71          | Mixed corn (Purple pigmented corn)        | SB-8.0                 | Mold damage                              |
| (C) OF-7.8           | Slightly yellow in (White waxy) corn      | SB-8.1                 | Mold damage (Pink)                       |
| (C) OF-7.9           | Yellow and White corn (Waxy)              | SB-9.0                 | Sprout damage                            |
| (C) OF-7.91          | Yellow and White corn (Non waxy)          | SB-10.0                | Stinkbug or insect stung kernels         |
|                      |   | SB-12.0                | Soybeans of other colors                 |
|                      |   | SB-13.0                | Shriveled and wrinkled                   |

**VISUAL REFERENCE IMAGES**

| <u>SUNFLOWER SEED</u> |  | <u>OTHER FACTORS</u> |   |
|-----------------------|--|----------------------|---|
| SS-1.0                | Damaged-by-heat                          | OF-1.0               | Animal filth                                  |
| SS-2.0                | Heat damage                              | OF-2.2               | Wild brome grass seeds                        |
| SS-3.0                | Surface mold                             | OF-3.0               | Castor beans                                  |
| <br><u>WHEAT</u>      |  | OF-4.0               | Chess   |
| W-1.0                 | Black tip damage (Fungus)                | OF-5.0               | Cob joints                                    |
| W-2.0                 | Scab damage                              | OF-6.0               | Cocklebur, Yellow star thistle, star/sand bur |
| W-3.0                 | Frost damage (Blistered)                 | OF-8.0               | Crotalaria seeds                              |
| W-3.1                 | Frost damage (Candied)                   | OF-8.1               | Velvet leaf seeds                             |
| W-3.2                 | Frost damage (Discolored black or brown) | OF-9.0               | Cultivated buckwheat                          |
| W-3.3                 | Frost damage (Flaked)                    | OF-10.0              | Einkorn                                       |
| W-4.0                 | Germ damage                              | OF-11.0              | Emmer   |
| W-4.1                 | Mold damage                              | OF-12.0              | Ergot   |
| W-4.2                 | Germ damage (Bleach method)              | OF-13.0              | Green garlic bulblets (Whole)                 |
| W-5.0                 | Green damage (Immature)                  | OF-13.1              | Dry garlic bulblets (0.33)                    |
| W-6.0                 | Heat damage (Durum)                      | OF-14.0              | Guar  |
| W-6.1                 | Heat damage (Other than durum)           | OF-15.0              | Hull-less barley                              |
| W-7.0                 | Other damage (Mold)                      | OF-18.0              | Polish wheat                                  |
| W-8.0                 | Sprout damage                            | OF-19.0              | Poulard wheat                                 |
| W-8.1                 | (A) Insect chewed, (B) Sprout sockets    | OF-20.0              | Rice types                                    |
| W-9.0                 | Weevil or insect bored                   | OF-21.0              | Safflower seed                                |
| W-9.1                 | Insect chewed wheat (Not damaged)        | OF-22.0              | Smut balls                                    |
| (W) OF-17.0           | Unknown foreign substance (Pink wheat)   | OF-24.0              | Spelt   |
| (W) OF-23.0           | Smut in wheat (Tagged ends)              | OF-25.0              | Sunflower seed                                |
| (W) OF-30.0           | Threshed and unthreshed kernels          | OF-26.0              | Triticale                                     |
|                       |  | OF-27.0              | Wild buckwheat and similar seeds              |
|                       |  | OF-28.0              | Wild oats                                     |
|                       |  | OF-31.0              | Suspected fertilizer (FSUB)                   |
|                       |  | OF-32.0              | Sclerotia                                     |
|                       |  | OF-34.0              | Cotton seed                                   |
|                       |  | OF-35.0              | Malted barley                                 |

**INTERPRETIVE LINE PRINTS**

|                         |  |
|-------------------------|--|
| <u>Soybeans</u>         | Mottled or stained by pokeberry stain<br>Mottled or stained by the growth of a fungus<br>Mottled or stained by dirt or dirt-like substance   |
| <u>Sorghum</u>          | Badly weathered (sorghum/tannin and white appearance mixed)<br>Badly weathered (sorghum or tannin appearance)<br>Badly weathered (white appearance)<br>Distinctly discolored (sorghum/tannin and white appearance mixed)<br>Distinctly discolored (sorghum or tannin appearance)<br>Distinctly discolored (white appearance) |
| <u>Oats</u>             | Materially weathered<br>Slightly weathered   |
| <u>Hard White Wheat</u> | Hard White wheat color line  |

### 1.3 WORK RECORDS

FGIS personnel shall use Forms FGIS-920, "Grain Sample Ticket," FGIS-918, "Sample Pan Ticket," FGIS-919, "Sampling Ticket," or FGIS-921, "Inspection Log," to record all sampling and inspection information.

Agency personnel shall use similar work forms to record all sampling and inspection information.

### 1.4 PRELIMINARY EXAMINATIONS

Inspection personnel sampling grain must: (1) observe the uniformity of the grain as to kind, quality, and condition; (2) draw an original sample; and (3) report the results to the inspector.

The inspector must consider the sampler's observations when determining the representativeness of the sample. If the inspector suspects the sample is not representative, the inspector should consult with the sampler and, if necessary, dismiss the inspection or arrange to obtain another sample.

### 1.5 DEFINITIONS

- a. File Sample. A representative portion of an official sample (approximately 1,400 grams or more).
- b. Identity (Kind of Grain). A determination as to whether a sample meets the definition of a specific grain or oilseed as established in the Official U.S. Standards for Grain.
- c. Representative Portion. A part or limited quantity of grain separated from the original sample by means of an approved device.
- d. Representative Sample. The terms "Representative Sample" and "Original Sample" are used interchangeably in the Grain Inspection Handbook and refer to a sample of approximately 2,800 grams in size drawn from a grain lot by official inspection personnel using approved procedures and sampling devices. See Book I, Sampling, for further information on sampling.
- e. Work Sample. A representative portion of grain of sufficient size (approximately 1,000 - 1,050 grams) to make determinations required for a particular grain.
- f. Review Inspection. A reinspection, appeal inspection, or Board appeal inspection service.

## **1.6 BASIS OF DETERMINATION**

Each chapter in Grain Inspection Handbook, Book II, provides a definition for basis of determination which establishes the rules for testing/analyzing all factors. Do not analyze any factor until the basis for making the determination is known.

## **1.7 SUBMITTED SAMPLE INSPECTIONS**

According to section 800.80(a)(4) of the regulations under the United States Grain Standards Act, "A submitted sample inspection service shall be based on a submitted sample of sufficient size to enable official personnel to perform a complete analysis for grade. If a complete analysis for grade cannot be performed because of an inadequate sample size or other conditions, the request for service shall be dismissed or a factor only inspection may be performed upon request." For the purpose of providing a complete inspection, due to the requirement that the test weight of the grain be shown on each certificate for grade, "sufficient size" is defined as being of sufficient quantity to overflow the test weight kettle (minimum). Samples containing less than this amount shall be limited to factor(s) only inspection.

The amount of sample required to be submitted for a factor(s) only inspection depends on the factor(s) information being requested. Certain objective factors/official criteria (e.g., moisture and protein/oil content) require specific quantities of grain in order for the equipment used in the determination to function properly. Whenever the amount of grain used in these determinations deviates from the prescribed amount, the accuracy of the determination is sacrificed. Consequently, inspection requests for samples containing less than these specified amounts must be dismissed.

For factors not dependent on equipment requiring specific portion sizes, the amount of sample submitted for factor only inspections may vary since the inspection results only represent the amount of grain submitted. The analysis of a submitted sample for subjective factors (e.g., damage and foreign material) or other objective factors (e.g., dockage and shrunken and broken kernels) is not compromised through the use of portion sizes which are less than those specified in individual chapters of this handbook. Consequently, unless restricted by equipment performance requirements, factor only inspection requests may be performed on submitted samples which contain less grain than the portion size prescribed in this handbook.

## **1.8 DISCLAIMER CLAUSE**

The mention of firm names or trade products does not imply that they are endorsed or recommended by the United States Department of Agriculture over other firms or similar approved products not mentioned.

## 1.9 BOERNER DIVIDER

The Boerner divider reduces the size of a grain sample while maintaining the representativeness of the original sample. Use the Boerner divider, or a divider that gives equivalent results, when reducing a sample to the portion size required for a specific test/analysis.

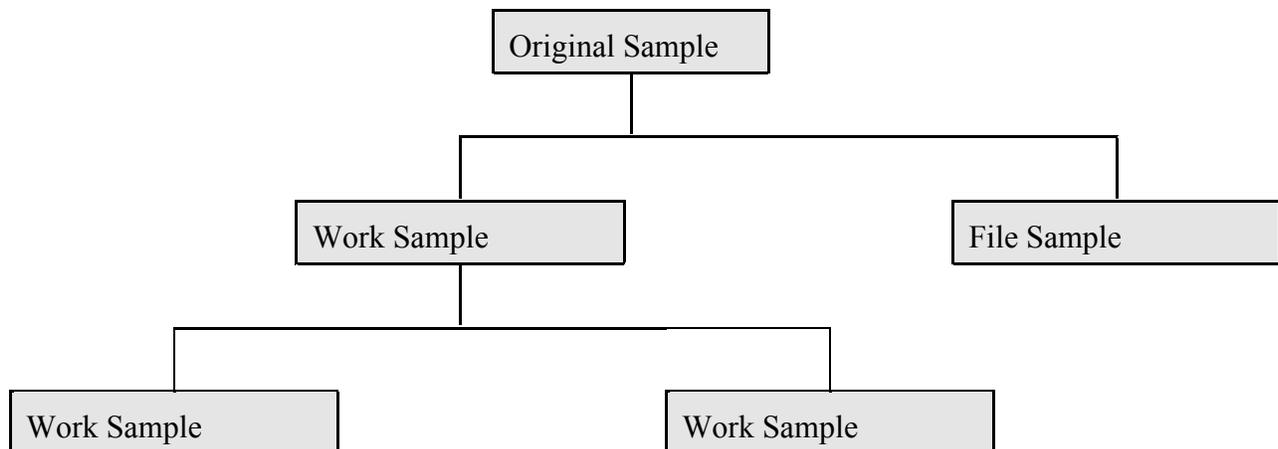
a. General Operating Procedures.

- (1) Check the divider for condition and cleanliness.
- (2) Close the hopper valve.
- (3) Place empty collection pans under the discharge spouts.
- (4) Pour the sample into the hopper.
- (5) Open the valve quickly. For large samples, feed more grain into the hopper during the dividing process.

For more specific information on the operation, maintenance, and performance testing of Boerner dividers, see chapter 7 of the Equipment Handbook.

b. Processing the Original Sample. Use the Boerner divider to subdivide the original sample into a file sample and appropriate work samples.

Chart - Processing Original Sample



- c. Processing the Work Sample. Refer to the individual grain chapters for specific information on processing the work sample.

### 1.10 GAC 2100 MOISTURE METER

The DICKEY-john Grain Analysis Computer GAC 2100 is the designated official moisture meter for performing moisture analysis in grains.

- a. Environmental Conditions. Ensure that the moisture meter is placed in a room that is within the manufacturer's basic requirements of 10-40° C (50-104° F). To minimize the effects of instrument temperature in official inspection, it is recommended that the laboratory temperature for the GAC 2100 be maintained within the range of 15-30° C (approx. 60-85° F).
- b. Instrument Temperature. The built-in GAC 2100 instrument temperature range limit is 10-40° C (50-104° F). If the instrument temperature is determined to be outside the range of 10-40° C, no moisture results will be displayed.
- c. Sample Temperature. The built-in GAC 2100 sample temperature range limit is 0-40° C (32-104° F). If the instrument's measured sample temperature is outside the range of 0-40° C, no moisture results will be displayed. For optimum accuracy and consistency in official inspection, it is recommended that the sample temperature be brought within the range of 10-32° C (50-90° F) before performing moisture determinations.
- d. Sample-Instrument Temperature Difference. The built-in GAC 2100 sample-to-instrument temperature difference limit is 20° C (36° F). If the instrument finds the sample temperature to be different from the instrument temperature by more than 20° C, it will not display moisture results. For optimum accuracy and consistency in official inspection, it is recommended that the difference between the grain and instrument temperature not exceed 11° C (20° F).
- e. Analytical Portion Size. The GAC 2100 does not require weighing a portion size. A representative portion size of approximately 225 grams is required for moisture testing purposes for oats and sunflower seed. For all other grains a portion of approximately 350 grams is required.

- f. Type of Container. Keep all samples in sealed moisture-proof containers if they can not be tested within approximately 15 minutes. Do not use paper bags, fiber cartons, etc., as containers for moisture samples because they tend to draw moisture from the sample.

Containers found to be most practical for retaining moisture are plastic, 1-pint containers. **CAUTION:** Do not place paper **into** moisture samples because paper absorbs moisture and lowers the moisture of the grain.

- g. Recording Results. The GAC 2100 does not require manual calculations or the reading of charts, therefore eliminating the use of a moisture log. Official personnel will maintain a work record on the pan ticket and certificate.

- h. General Operating Procedures.

- (1) Pour the sample through the divider at least once (to mix the sample) before filling the hopper.
- (2) Select the appropriate grain from the menu.
- (3) Fill the sample hopper located on top of the unit with enough grain to fill the measuring cell inside the instrument (heap grain slightly). The exact volume of grain is not important, except enough grain must be present to overfill the cell (approximately one pint). When the test begins, any excess grain spills over the cell and drops into the sample drawer. If the amount of grain is insufficient to overfill the test cell, depress UNLOAD to dump the sample and repeat the test with a sufficient sample size.
- (4) Depress the LOAD key on the keyboard to start the test cycle.
- (5) Wait briefly for the moisture test to finish.
- (6) Observe the results of the test on the display and record the results on the work record.
- (7) When finished with the measurement, depress the UNLOAD key.

NOTE: The GAC 2100 is equipped to report moisture outside the approved range for the calibration. An error indication will notify the operator if the calibration range is exceeded. When the moisture reading exceeds the approved calibration range, another determination shall be made from the work sample or file. If the second determination is not outside the approved calibration range, use the second moisture result. Otherwise, the final moisture shall be based on the average of the two determinations and rounded to the nearest 0.1 percent moisture.

- (8) For additional instructions, refer to the GAC 2100 operator's manual.

### 1.11 TEST WEIGHT PER BUSHEL APPARATUS

Test weight per bushel is the weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device.

The determination for test weight is made on a portion of sufficient quantity to overflow the kettle. Before making a determination, refer to the chapter covering the grain being tested for the basis of determination and certification requirements.

#### General Operating Procedures:

- a. Level and balance the test weight per bushel apparatus.
- b. Close the hopper valve.
- c. Pour the work sample into the hopper.
- d. Center the hopper over the kettle.
- e. Fill the kettle by opening the hopper valve quickly.
- f. Move the hopper all the way to the left before proceeding. Do not jar the apparatus. Jarring could cause inaccurate results.
- g. Using a standard stoker, stroke the kettle by holding the stoker in both hands with the flat sides in a vertical position. Level the grain in the kettle by making three full-length, zigzag motions with the stoker.
- h. Convert the weight of the sample by either the "standard" method or one of the "alternate" methods.
  - (1) Standard Method. Carefully hang the kettle on the beam and move the weights until the beam is balanced. Read the test weight per bushel scale.
  - (2) Alternate Method - Manual Conversion. Pour the sample from the kettle onto a general class scale, note the weight of the sample, find the gram weight on the test weight conversion chart (see Appendix 1), and read the corresponding test weight per bushel shown to the right of the gram weight.

- (3) Alternate Method - Automatic Conversion. When using an electronic scale programmed to convert gram weight to pounds per bushel select the appropriate test weight mode. Place an empty sample pan or the test weight kettle on the scale and zero the scale. Pour the sample from the kettle into the sample pan or place the filled kettle onto the scale as appropriate. Read the result from the test weight mode selected.

**NOTE: While all grain samples may be weighed and converted to pounds per bushel (lb/bu) using these electronic programmed scales, DO NOT use these scales to convert gram weight to kilograms per hectoliter (kg/hl) for wheat, as they are only programmed using the 1.287 conversion factor referenced above.**

- i. Record the test weight per bushel on the work record and certificate as prescribed for the particular grain being tested. (Refer to the appropriate grain chapter in this handbook.) Upon request, convert the pounds per bushel to kilograms per hectoliter. Refer to the test weight per bushel/kilogram per hectoliter conversion table (see Appendix 2) or use the appropriate formula listed in Table No.1 below to determine kilograms per hectoliter. Record the results (to the nearest tenth kg/hl) in the “Remarks” section of the certificate.

**TABLE NO. 1**

| <b>TEST WEIGHT PER BUSHEL CONVERSIONS</b> |                          |                                      |                          |
|---|--------------------------|--------------------------------------|--------------------------|
| From: Pounds Per Bushel (lb/bu)           |                          | To: Kilograms Per Hectoliter (kg/hl) |                          |
| Grain                                     | Input*                   | Formula                              | Result                   |
| Durum Wheat                               | Pounds per bushel result | $(lb/bu \times 1.292) + 0.630$       | Kilograms per hectoliter |
| All other Wheat types                     | Pounds per bushel result | $(lb/bu \times 1.292) + 1.419$       | Kilograms per hectoliter |
| All other grains                          | Pounds per bushel result | $lb/bu \times 1.287$                 | Kilograms per hectoliter |

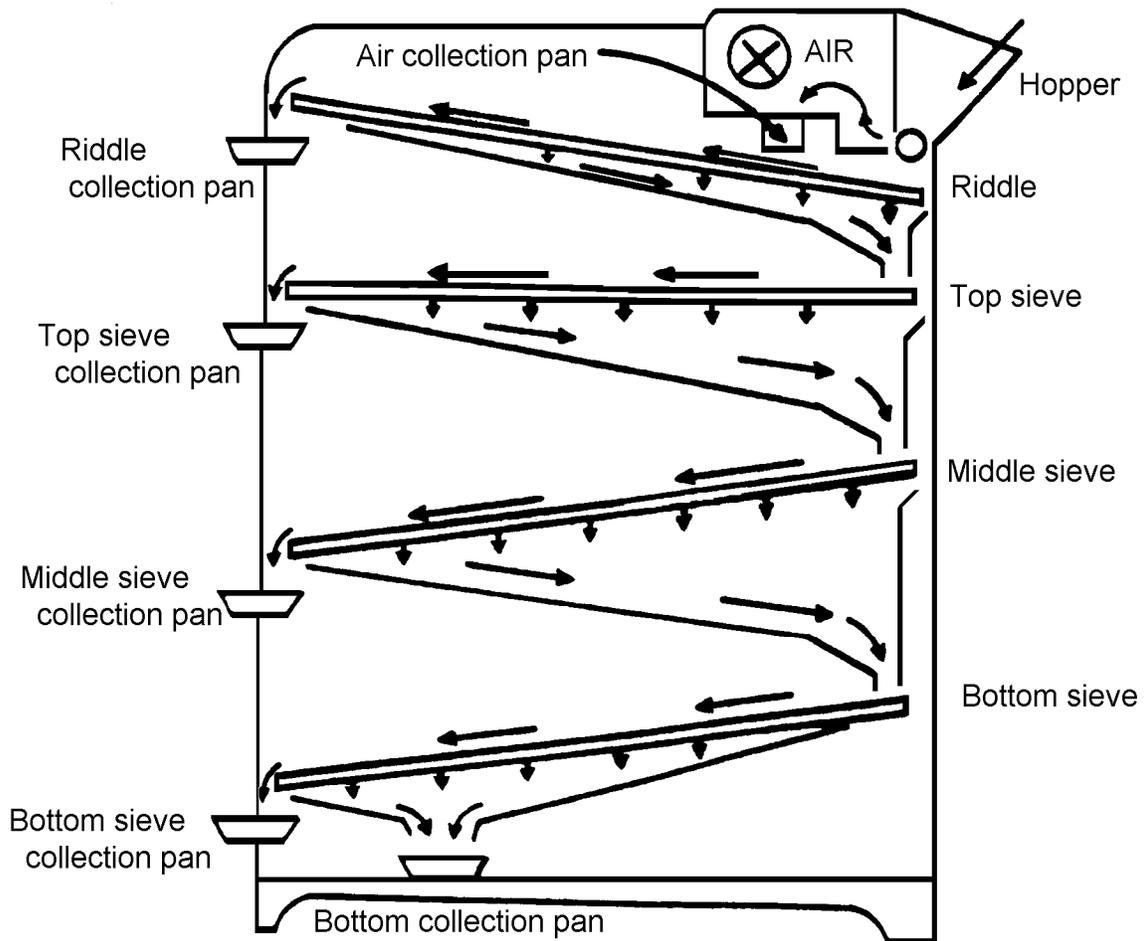
\* Use the appropriate test weight per bushel result (e.g., whole and half pound, whole and tenth pound)

For more specific information on the operation, maintenance, and performance testing of the test weight per bushel apparatus, see chapter 5 of the Equipment Handbook.

## 1.12 CARTER DOCKAGE TESTER

The Carter dockage tester uses aspiration (air) and a combination of riddles and sieves to prepare samples for grading by removing the readily separable foreign matter. Generally, the foreign material removed consists of all matter lighter, larger, or smaller than grain.

**CARTER DOCKAGE TESTER FLOW CHART**



### General Operating Procedures:

- a. Set air and feed controls at the prescribed settings.
- b. Place the riddle, if applicable, and sieve(s) in the prescribed locations.

Table No. 2 lists the proper riddles, sieves, air, and feed control settings to use for each type of grain.

**TABLE NO. 2**

| <b>EQUIPMENT SCHEDULE &amp; CONTROL SETTINGS</b> |     |      |                     |           |              |              |
|--|-----|------|---------------------|-----------|--------------|--------------|
| Type of Grain                                    | Air | Feed | Riddle              | Top Sieve | Middle Sieve | Bottom Sieve |
| Wheat other than Durum                           | 4   | 6    | 2                   |           | 2            | 2            |
| Durum wheat                                      | 4   | 6    | 25                  |           | 2            | 2            |
| Rye  | 4   | 6    | 25                  |           | 2            | 2            |
| Corn   | 1   | 10*  |                     | 3         |              |              |
| Barley   | 4   | 6    | 6                   | 8         | 6            |              |
| Flaxseed   | 3 ½ | 4    | 000                 | 4         | 2            | 7            |
| Sorghum  | 1   | 6    | 6                   | 6         |              | 1            |
| Triticale  | 4   | 6    | 25                  |           | 2            | 2            |
| Sunflower Seed                                   | 6*  | 7 ½  | Oil Seed<br>(35898) | 3         |              | 8            |
| Canola   | 5   | 3    | 000                 | 4         |              |              |

\* Setting may vary, refer to the Equipment handbook.

Wheat, rye, triticale, and canola have additional testing procedures when they contain excessive quantities of wild buckwheat, cob joints, ches and similar types of seeds, and flaxseed. Refer to the appropriate chapters for the limits and specific instructions on how to set the Carter dockage tester when this material is found.

- c. Check the air collection pan to see if it is empty and place the collection pans in the prescribed locations.
- d. Turn the tester on.

- e. Pour the work sample into the hopper.
- f. When all of the grain has cleared the hopper, riddle (if applicable), and sieves, turn the tester off.
- g. Collect all material separated by the aspirator, riddle (if used), and sieves. Combine the material as prescribed in the chapter covering the particular grain.

For more specific information on operation, maintenance, and performance testing procedures, see chapter 4 of the Equipment Handbook.

### **1.13 MECHANICAL SIEVE SHAKER**

The grading of certain grains requires that some portions be sieved. This is accomplished either by (1) hand or (2) mechanical sieving. Mechanical sieving is preferred over the hand-sieving method because the results are more uniform and accurate in counting the number of strokes. The mechanical sieve shaker has a range of 1 to 120 strokes, always starting and stopping in the same position. One complete stroke should take approximately 1 second.

**TABLE NO. 3**

| <b>FACTORS THAT REQUIRE SIEVING</b>             |                                |                |  |                               |
|---|--------------------------------|----------------|--|-------------------------------|
| Grain   | Factor                         | Strokes        | Manufacturers' Designation Sieve Size (Inches) | Metric Conversion Millimeters |
| Wheat   | Shrunken and Broken Kernels    | 30             | 0.064 x 3/8 oblong *                           | 1.63 x 9.53                   |
| Barley  | Thin: Barley                   | 30             | 5/64 x 3/4 slot *                              | 1.98 x 19.05                  |
|   | Thin: Six-rowed Malting Barley | 30             | 5/64 x 3/4 slot *                              | 1.98 x 19.05                  |
|   | Thin: Two-rowed Malting Barley | 30             | 5.5/64 x 3/4 slot *                            | 2.18 x 19.05                  |
|   | Plump                          | 30             | 6/64 x 3/4 slot *                              | 2.38 x 19.05                  |
| Rye   | Thin and Plump                 | 30             | 0.064 x 3/8 oblong *                           | 1.63 x 9.53                   |
| Soybeans  | Foreign Material               | 5              | 8/64 round                                     | 3.175                         |
| Triticale                                       | Shrunken and Broken Kernels    | 30             | 0.064 x 3/8 oblong *                           | 1.63 x 9.53                   |
| Oats  | Thin                           | 30             | 0.064 x 3/8 oblong *                           | 1.63 x 9.53                   |
| Sunflower Seed                                  | Admixture                      | See Chapter 11 | 5/64 inscribed circle                          | 1.98                          |
| Canola  | Dockage                        | 30             | 0.028 x 15/32 oblong                           | 0.71 x 11.906                 |
|   |                                | 30             | 0.035 x 15/32 oblong                           | 0.89 x 11.906                 |
|   |                                | 30             | 0.0395 x 15/32 oblong                          | 1.0 x 11.906                  |
| * Precision sieves, refer to Equipment Handbook |                                |                |  |                               |

General Operating Procedures:

- a. Refer to the individual grain chapters for the basis of determination and portion size.
- b. Make sure the shaker is level.
- c. Select the proper sieve and place it over a bottom pan.
- d. Mount the sieve and bottom pan in the sieve holder making sure that the slotted or oblong perforations are parallel with the sieving action.
- e. Set the stroke counter for the required number of strokes.
- f. Gently pour the representative portion of grain in the center of the sieve.
- g. Turn the machine on.

- h. After the required number of strokes has been completed, the machine will automatically stop.
- i. Carefully remove the sieve and bottom pan. Jarring the sieve will cause the material remaining on top to pass through the perforations, leading to inaccurate results.
- j. Combine the material lodged in the perforations with the material that remained on top of the sieve. To remove the lodged material from the perforations, rub the sieve bottom gently. Tapping will warp the sieve and lead to inaccurate results in future determinations.

For more specific information on the operation, maintenance, and performance testing of sieves and sieve shakers, see chapter 9 of the Equipment Handbook.

#### **1.14 BARLEY PEARLER**

The barley pearler dehulls barley and sunflower seed for certain factors. The machine uses a carborundum wheel controlled by a time switch. The wheel removes the hulls and a screen separates the hulls and powdered barley or sunflower seed hulls from the pearled barley or sunflower seed.

Barley pearlers are individually standardized by adjusting the length of time the barley remains in the pearling chamber while the wheel is in motion. Post the standardized pearling time conspicuously on each machine.

##### General Operating Procedures:

- a. Before placing the portion into the pearler:
  - (1) Run the pearler and open the slide to ensure that the pearling chamber is empty.
  - (2) Remove and empty the drawers that catch the barley hulls and pearled portion. Replace them.
  - (3) Securely close the slide.
- b. Pour the sample into the hopper and replace the lid.
- c. Set the time for the grain being pearled.

- d. After pearling, pull out the slide and allow the pearled portion to drop into the drawer. With the slide open, briefly restart the machine and clear the pearling chamber.
- e. Proceed with the determination as described in the appropriate chapter of the handbook.

For more specific information on the operation, maintenance, and performance testing of barley pearlers, see chapter 8 of the Equipment Handbook.

### 1.15 LABORATORY SCALES

- a. Weigh work portions and separations from work portions using an approved grain test scale with an appropriate division size as follows:

**TABLE NO. 4**

| <b>REQUIRED DIVISION SIZES</b>   |                      |                    |                          |
|--|----------------------|--------------------|--------------------------|
| Work Portion   | Division Requirement |                    | Accuracy Class           |
|  | e                    | d                  |                          |
| $\leq 100$ grams   | $e \leq 0.1$ gram    | $d \leq 0.01$ gram | II (expanded resolution) |
| $> 100$ grams  | $e \leq 0.1$ gram    | $d \leq 0.1$ gram  | II, III                  |
| $> 500$ grams  | $e \leq 1$ gram      | $d \leq 1$ gram    | II, III                  |
| d = The smallest scale division displayed.<br>e = The size of the division used for accuracy test purposes.<br>See Chapter 2 of the Equipment Handbook for additional information. |                      |                    |                          |

- b. Some expanded resolution scales have cross-hatching over the least significant digit on the display. The last digit is ignored when testing the scale, but should be used when weighing work portions or separations.
- c. Choose the appropriate scale based on the work portion size. The work portion and the separation shall be weighed using a scale with the same (or better) maximum division size. For example:
  - (1) Weigh a work portion of 1,000 grams on a scale with  $e \leq 1$  gram  $d \leq 1$  gram. Weigh the separation on the same (or better) scale.
  - (2) Weigh a work portion of 250.4 grams on a scale with  $e \leq 0.1$  gram  $d \leq 0.1$  gram. Weigh the separation on the same (or better) scale.

- (3) Weigh a work portion of 60.02 grams on a scale with  $e \leq 0.1$  gram  $d \leq 0.01$  gram (expanded resolution is acceptable). Weigh the separation on the same (or better) scale.
- (4) Certain factors are sometimes certified to the nearest hundredth percent. Therefore, use a scale with  $e \leq 0.1$  gram  $d \leq 0.01$  gram (expanded resolution is acceptable).
- (5) If you need assistance in determining if a scale is being used appropriately, or that it is configured with the correct division size, consult the Approved Equipment List or contact the Policies and Procedures Branch.

## 1.16 ROUNDING

When certificating official results, use the following procedures for rounding unless otherwise specified.

A hand-held calculator or computer may be used to calculate results and to provide rounding.

- a. If the calculating device is programmable, set the device to the number of decimal places or whole number needed for reporting on the work record or certificate. Test the results to ensure that the rounding procedure is identical to the FGIS rounding method described in b. below. Otherwise, set the calculating device to the floating mode and carry the results one decimal place further than the level required and round the final results as in b. below.
- b. When the figure to be rounded is followed by a figure greater than or equal to 5, round to the next higher figure; for example, report 6.35 as 6.4, 0.45 as 0.5, etc. When the figure to be rounded is followed by a figure less than 5, retain the figure; for example, report 8.34 as 8.3, 1.22 as 1.2, etc.

Record all the information on the certificate as shown in Table No. 5 - Certifying Percentages and Test Weight.

**TABLE NO. 5**

| <b>CERTIFYING PERCENTAGES AND TEST WEIGHT</b>    |   |  |
|--|---|--|
| <b>Factor</b>                                    | <b>Grain</b>  | <b>Certified to</b>  |
| Class  | Barley  | Nearest whole percent  |
| Class and Subclass                               | Wheat   | Nearest whole percent  |
| Dockage  | Flaxseed, and Sorghum<br>Barley, Triticale<br>Wheat, Rye  | Whole percent, fraction disregarded<br>Whole & half percent, fraction disregarded<br>Nearest tenth percent                                 |
| Ergot  | All Grains  | Nearest hundredth percent  |
| Foreign material and/or foreign material & fines | Mixed grain<br>Sunflower seed<br>All other grains         | Nearest whole percent<br>Nearest whole & half percent <u>1/</u><br>Nearest tenth percent   |
| Flint and Dent, Flint, & waxy                    | Corn  | Nearest whole percent  |
| Identity (kind of grain)                         | All grains  | Nearest whole percent  |
| Each kind of grain                               | Mixed grain   | Nearest whole percent  |
| Plump  | Barley  | Range <u>2/</u>  |
| Sclerotinia                                      | Soybeans<br>Canola  | Nearest tenth percent<br>Nearest hundredth percent   |
| Smut   | Barley  | Nearest hundredth percent  |
| Stones   | Canola  | Nearest hundredth percent  |
| Test weight                                      | Corn, Rye, Soybean, Triticale & Wheat<br>All other grains | Whole & nearest tenth pound & whole & nearest tenth kilogram<br>Whole & half pound, fraction disregarded, & whole & nearest tenth kilogram |
| All other factors                                | All grains  | Nearest tenth percent  |

1/ Sunflower seed foreign material is reported as follows: 0.0 to 0.24 as 0.0 percent, 0.25 to 0.74 as 0.5 percent, etc.  
2/ Ranges of plump shall be: Below 50 percent, 50 to 55 percent, 56 to 60 percent, 61 to 65 percent, etc.

## 1.17 EQUIPMENT AND MATERIALS

The equipment and materials for performing the bleach test for determining germ-damaged kernels in sorghum and wheat and for the iodine test for determining waxy corn are as follows:

- a. Safety Equipment - Bleach and Iodine Tests.
  - (1) Full face protection shield.
  - (2) Impervious plastic or rubber apron and gloves.
  - (3) Exhaust system.
  - (4) Eye wash station.
  - (5) Hand held spray.
  
- b. Equipment and Materials - S/J Mixer Bleach Test. Properly functioning equipment and adherence to established procedures are vital to the successful removal of the sorghum seed coat.
  - (1) Potassium Hydroxide (KOH) Pellets (85-90%). KOH is a caustic chemical that functions to generate the heat necessary for the bleaching reaction to occur. Due to the hygroscopic nature (readily absorbs water) of this chemical, continued or prolonged exposure to air/moisture significantly reduces its strength. To ensure that the KOH provides satisfactory, repeatable results, it is critical to control the amount and purity of the KOH pellets used in the bleaching process.
    - (a) Do not use KOH pellets that appear shiny or that clump together. Such conditions indicate that the pellets have absorbed water to the extent that it will significantly reduce the KOH's heat generating capability.
    - (b) Between samples and at the end of the day make sure the lid is tightly secured to the jar.
  - (2) Sodium Hypochlorite (Bleach). Bleach serves a dual purpose in the bleaching process. It provides the moisture necessary to generate heat by dissolving the KOH pellets. It also combines with the KOH to chemically remove the seedcoat. To ensure that a satisfactory reaction occurs, control the type, amount, and concentration of bleach used in the process as follows:

(a) Measure exactly 40.0 ml of bleach using a 50-ml or 100-ml graduated cylinder or a dispenser. If dispensers are used, they must meet the following criteria:

- Cylinder capacity: 50 ml
- Accuracy:  $\pm 1.0$  percent
- Reproducibility:  $\pm 0.1$  percent

When ordering dispensers, make sure the plunger assembly is capable of fitting the type/size of reagent bottle you are using. Examples of dispensers meeting this criteria include the Brinkman dispensette and Repipet dispenser which are available through Fisher Scientific (1-800-766-7000), catalog number 13-688-70 and 13-687-57, respectively.

(b) Use major brands of bleach only (e.g., Clorox, Purex) that contain at least 5.25% active ingredients. Do not use regional or local brands due to the potential variations that exist in the concentration level of the bleach.

(c) To maintain a consistent concentration of bleach (5.25%), record the purchase/expiration (3 months after purchase) date of the bleach on the bottle. Replace any bleach exceeding the expiration date.

(3) Vinegar to neutralize any spilled KOH.

(4) Teaspoon.

(5) Polyethylene coated weighing paper, 3 inches in diameter.

(6) Balance.

(7) 100-ml graduated cylinder.

(8) Timer. Verify the accuracy of the timer setting immediately prior to sorghum harvest and as necessary thereafter to maintain a mixing time of 3 minutes  $\pm 10$  seconds.

(9) S/J mixer. Make sure there is no hesitation in the rotation of the stirring blade.

- (a) Stir jar and assembly for S/J mixer.
  - (b) One extra stirring head for each mixer as well as several mixing jars are recommended.
  - (10) Small tea strainer.
  - (11) Paper towels.
  - (12) Drying apparatus (hair dryer modified with sieve to dry bleached kernels).
- c. Equipment and materials - Iodine Test. The equipment and materials for determining waxy corn are as follows:
- (1) Cutting implement.
    - (a) Sharp knife; or
    - (b) Razor blade.
  - (2) Spray bottle.
    - (a) Dark-colored, trigger-spray, polyethylene bottle; or
    - (b) Amber colored borosilicate glass with atomizer bulb.
  - (3) Petri dish or porcelain plate or other stain-resistant container.
  - (4) Wax paper, plastic wrap, or plastic sheets to spread on work surfaces.
  - (5) Iodine stock solution.

**CAUTION: Protect containers of iodine (crystals and solutions) from physical damage. Perform all mixing in a well ventilated area or within the working area of a laboratory hood.**

Follow steps (a) through (f) to prepare the iodine stock solution.

- (a) Weigh out 10 grams of iodine crystals and 20 grams of potassium iodide crystals.
- (b) Measure 1,000 ml of distilled water.

- (c) Pour the distilled water into an amber-colored bottle.
- (d) Dissolve the 20 grams of potassium iodide crystals in the distilled water.
- (e) Add the 10 grams of iodine crystals.
- (f) Mix thoroughly. Label the bottle "Iodine Stock Solution." Post poison labels on the bottles.

**NOTE: Iodine crystals and potassium iodide crystals can be purchased from chemical supply companies or from pharmacies.**

#### 1.18 FILE SAMPLE RETENTION (GRAIN)

- a. General. To accomplish the mission of the agency, FGIS has established the policy of maintaining an effective record management program. Part of the official record system is the maintenance of file samples retained for reference or review purposes. Reference FGIS Program Directive 9170.13, Uniform File Sample Retention System, for detailed procedures.
- b. Use of File Sample. Official personnel shall establish and maintain a file sample retention system in accordance with the regulations and applicable instructions. File samples may be used for:
  - (1) Monitoring purposes by official personnel;
  - (2) Supplementary completion of the original grade (e.g., infestation, odor, etc.);
  - (3) Review by interested persons;
  - (4) Reinspections, appeals, and Board appeals;
  - (5) Answering trade complaints; and
  - (6) Training.
- c. Sample Retention. Official personnel may, at their discretion, keep file samples for a period longer than required. The minimum retention periods (calendar days) are as follows:

**TABLE NO. 6**

| FILE SAMPLE RETENTION          |              |     |        |       |
|--------------------------------|--------------|-----|--------|-------|
|                                | MINIMUM DAYS |     |        |       |
|                                | IN           | OUT | EXPORT | OTHER |
| Trucks                         | 3            | 5   | 30     | -     |
| Railcars                       | 5            | 10  | 30     | -     |
| Barges (River)                 | 5            | 25  | -      | -     |
| Ships & Barges (lake or ocean) | 5            | 25  | 90     | -     |
| Bins & Tanks                   | -            | -   | -      | 3     |
| Submitted samples              | -            | -   | -      | 3     |
| Containers                     | -            | -   | 60     | -     |

When an agency file sample is used to complete an appeal inspection or selected for monitoring, the monitoring office shall maintain the sample for the applicable retention period.

- d. Sample Size. File samples shall be of sufficient size to accommodate subsequent examinations or analysis. Samples retained for grade should be approximately 1,400 grams or more, except for the lighter grains (e.g., oats, sunflower seed, etc.), that require less grain to determine grade. For factor only tests or official criteria (e.g., wheat protein), smaller file samples should prove sufficient to handle review services. File samples larger than 1,400 grams may be retained if deemed necessary to provide subsequent inspection service.
  
- e. Retention of Worked File Samples. If possible, retain an unworked portion of a representative sample or submitted sample as the final file. The worked portion may be retained as the final file only when insufficient sample is available for an unworked file sample.
  
- f. File System. Official personnel must maintain a sample filing system that permits efficient retrieval of file samples and ensures adherence to required retention periods (paragraph c. above). Further, file samples must be protected against theft, manipulation, substitution, and unauthorized use.

Use large polyethylene bags, semi-rigid plastic containers, or metal containers to retain file samples. Use metal or semi-rigid plastic containers when samples contain an off odor.

- g. Disposal Procedures. Official personnel must keep complete and accurate disposition records. After file samples have served their intended purpose, dispose of the grain in accordance with criteria outlined in section 800.81(e) of the regulations and applicable instructions as follows:
- (1) Upon the applicant's request, return the file samples to the applicant;
  - (2) If the applicant does not request the return of the grain, it may be sold, donated, or destroyed; and
  - (3) If the grain contains toxic substances (e.g., treated seed, aflatoxin, etc.), dispose of the grain in accordance with applicable Federal, State, and local laws.

#### **1.19 UNOFFICIAL INSPECTION SERVICES**

Occasionally, official personnel receive requests from processors, producers, seed companies, etc., to perform certain analysis on grain or grain related products. While many tests differ from official determinations, some analyses are the same or very similar. The actual testing methodology used is often specified by trading rules or by the specific applicant.

Official personnel who receive requests for such analysis or service, such as seed grain testing, brown test in corn, and yield in oats, may perform the service(s) on an unofficial basis.

#### **1.20 METRIC SYSTEM**

The following tables are provided to assist in the conversion from the U.S. measurement system (inch-pound) to the metric system.

**TABLE NO. 7**

| <b>CONVERSIONS</b>                       |                        |             |                  |                          |
|--|------------------------|-------------|------------------|--------------------------|
| $A = C \div B$                           |                        |             | $C = A \times B$ |                          |
| Symbol                                   | A<br>Inch – Pound Unit | B<br>Factor | Symbol           | C<br>Metric Unit         |
| bu                                       | bushels (U.S.)         | 35.239      | hl               | hectoliters              |
| gal                                      | gallons (U.S.)         | 3.785       | L                | liters                   |
| in                                       | inches                 | 25.4        | mm               | millimeters              |
| lb                                       | pounds                 | 0.4536      | kg               | kilograms                |
| lb/bu                                    | pounds per bushel      | *           | kg/hl            | kilograms per hectoliter |
| qt                                       | quarts (dry)           | 1.101       | L                | liters                   |
| qt                                       | quarts (liquid)        | 0.946       | L                | liters                   |
| ton                                      | tons (short)           | 0.907       | t                | metric tons              |
| * See Table No.1 for conversion factors. |                        |             |                  |                          |

**TABLE NO. 8**

| <b>EQUIVALENTS</b> |                        |        |                        |        |           |        |           |
|--------------------|------------------------|--------|------------------------|--------|-----------|--------|-----------|
| Weight             |                        | Length |                        | VOLUME |           |        |           |
|                    |                        |        |                        | Dry    |           | Liquid |           |
| grain              | = 0.06 g               | 1 in   | = 2.54 cm<br>= 25.4 mm | 1 pt   | = 0.28 L  | 1 pt   | = 0.473 L |
| 1 oz               | = 28 g                 | 1 ft   | = .304 m               | 1 qt   | = 1.10 L  | 1 qt   | = 0.946 L |
| 1 lb               | = 0.45 kg              | 1 yd   | = 0.914 m              | 1 gal  | = 35.24 L | 1 gal  | = 3.785 L |
| 1 bu               | = 352.4 hl             |        |                        |        |           |        |           |
| 1 st               | = 907 kg<br>= 0.9t     |        |                        |        |           |        |           |
| 1 lt               | = 1016.0 kg<br>= 1.02t |        |                        |        |           |        |           |
| 1 ppb              | = 1 µg/kg              |        |                        |        |           |        |           |
| 1 ppm              | = 1 mg/kg              |        |                        |        |           |        |           |

**TABLE NO. 9**

| <b>MEASURES</b>                     |    |                                 |       |            |                                    |
|-------------------------------------|----|---------------------------------|-------|------------|------------------------------------|
| Pounds Per Bushel<br>(trade weight) |    | Bushels Per Ton                 | Short | Metric (t) | Bushels to Metric Tons             |
| Wheat, Soybeans,<br>Triticale       | 60 | Wheat, Soybeans,<br>Triticale   | 33.3  | 36.7       | Wheat, Soybeans = bu. x .027       |
| Corn, Sorghum,<br>Flaxseed, Rye     | 56 | Corn, Sorghum,<br>Flaxseed, Rye | 35.7  | 39.4       | Corn, Sorghum, = bu. x .025<br>Rye |
| Canola/Rapeseed                     | 50 | Canola/Rapeseed                 | 40.0  | 44.0       | Canola, = bu. x .023<br>Rapeseed   |
| Barley                              | 48 | Barley                          | 41.7  | 45.9       | Barley = bu. x .022                |
| Oats                                | 32 | Oats                            | 62.5  | 68.9       | Oats = bu. x .015                  |
| Sunflower Seed                      | 24 | Sunflower Seed                  | 83.3  | 91.9       | Sunflower Seed = bu. x .011        |

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| <b>TEST WEIGHT CONVERSION CHART</b>            |       |             |       |             |       |             |       |
|--|-------|-------------|-------|-------------|-------|-------------|-------|
| <b>GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)</b> |       |             |       |             |       |             |       |
| 275 – 295.5                                    |       | 296 – 316.5 |       | 317 – 337.5 |       | 338 – 358.5 |       |
| Grams  | lb/bu | Grams       | lb/bu | Grams       | lb/bu | Grams       | lb/bu |
| 275  | 19.4  | 296         | 20.9  | 317         | 22.4  | 338         | 23.8  |
| 275.5  | 19.4  | 296.5       | 20.9  | 317.5       | 22.4  | 338.5       | 23.9  |
| 276  | 19.5  | 297         | 21.0  | 318         | 22.4  | 339         | 23.9  |
| 276.5  | 19.5  | 297.5       | 21.0  | 318.5       | 22.5  | 339.5       | 24.0  |
| 277  | 19.5  | 298         | 21.0  | 319         | 22.5  | 340         | 24.0  |
| 277.5  | 19.6  | 298.5       | 21.1  | 319.5       | 22.5  | 340.5       | 24.0  |
| 278  | 19.6  | 299         | 21.1  | 320         | 22.6  | 341         | 24.1  |
| 278.5  | 19.6  | 299.5       | 21.1  | 320.5       | 22.6  | 341.5       | 24.1  |
| 279  | 19.7  | 300         | 21.2  | 321         | 22.6  | 342         | 24.1  |
| 279.5  | 19.7  | 300.5       | 21.2  | 321.5       | 22.7  | 342.5       | 24.2  |
| 280  | 19.8  | 301         | 21.2  | 322         | 22.7  | 343         | 24.2  |
| 280.5  | 19.8  | 301.5       | 21.3  | 322.5       | 22.8  | 343.5       | 24.2  |
| 281  | 19.8  | 302         | 21.3  | 323         | 22.8  | 344         | 24.3  |
| 281.5  | 19.9  | 302.5       | 21.3  | 323.5       | 22.8  | 344.5       | 24.3  |
| 282  | 19.9  | 303         | 21.4  | 324         | 22.9  | 345         | 24.3  |
| 282.5  | 19.9  | 303.5       | 21.4  | 324.5       | 22.9  | 345.5       | 24.4  |
| 283  | 20.0  | 304         | 21.4  | 325         | 22.9  | 346         | 24.4  |
| 283.5  | 20.0  | 304.5       | 21.5  | 325.5       | 23.0  | 346.5       | 24.4  |
| 284  | 20.0  | 305         | 21.5  | 326         | 23.0  | 347         | 24.5  |
| 284.5  | 20.1  | 305.5       | 21.6  | 326.5       | 23.0  | 347.5       | 24.5  |
| 285  | 20.1  | 306         | 21.6  | 327         | 23.1  | 348         | 24.6  |
| 285.5  | 20.1  | 306.5       | 21.6  | 327.5       | 23.1  | 348.5       | 24.6  |
| 286  | 20.2  | 307         | 21.7  | 328         | 23.1  | 349         | 24.6  |
| 286.5  | 20.2  | 307.5       | 21.7  | 328.5       | 23.2  | 349.5       | 24.7  |
| 287  | 20.2  | 308         | 21.7  | 329         | 23.2  | 350         | 24.7  |
| 287.5  | 20.3  | 308.5       | 21.8  | 329.5       | 23.2  | 350.5       | 24.7  |
| 288  | 20.3  | 309         | 21.8  | 330         | 23.3  | 351         | 24.8  |
| 288.5  | 20.4  | 309.5       | 21.8  | 330.5       | 23.3  | 351.5       | 24.8  |
| 289  | 20.4  | 310         | 21.9  | 331         | 23.4  | 352         | 24.8  |
| 289.5  | 20.4  | 310.5       | 21.9  | 331.5       | 23.4  | 352.5       | 24.9  |
| 290  | 20.5  | 311         | 21.9  | 332         | 23.4  | 353         | 24.9  |
| 290.5  | 20.5  | 311.5       | 22.0  | 332.5       | 23.5  | 353.5       | 24.9  |
| 291  | 20.5  | 312         | 22.0  | 333         | 23.5  | 354         | 25.0  |
| 291.5  | 20.6  | 312.5       | 22.0  | 333.5       | 23.5  | 354.5       | 25.0  |
| 292  | 20.6  | 313         | 22.1  | 334         | 23.6  | 355         | 25.0  |
| 292.5  | 20.6  | 313.5       | 22.1  | 334.5       | 23.6  | 355.5       | 25.1  |
| 293  | 20.7  | 314         | 22.2  | 335         | 23.6  | 356         | 25.1  |
| 293.5  | 20.7  | 314.5       | 22.2  | 335.5       | 23.7  | 356.5       | 25.2  |
| 294  | 20.7  | 315         | 22.2  | 336         | 23.7  | 357         | 25.2  |
| 294.5  | 20.8  | 315.5       | 22.3  | 336.5       | 23.7  | 357.5       | 25.2  |
| 295  | 20.8  | 316         | 22.3  | 337         | 23.8  | 358         | 25.3  |
| 295.5  | 20.8  | 316.5       | 22.3  | 337.5       | 23.8  | 358.5       | 25.3  |

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| TEST WEIGHT CONVERSION CHART            |       |             |       |             |       |             |       |
|---|-------|-------------|-------|-------------|-------|-------------|-------|
| GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU) |       |             |       |             |       |             |       |
| 359 – 379.5                             |       | 380 – 400.5 |       | 401 – 421.5 |       | 422 – 442.5 |       |
| Grams                                   | lb/bu | Grams       | lb/bu | Grams       | lb/bu | Grams       | lb/bu |
| 359                                     | 25.3  | 380         | 26.8  | 401         | 28.3  | 422         | 29.8  |
| 359.5                                   | 25.4  | 380.5       | 26.8  | 401.5       | 28.3  | 422.5       | 29.8  |
| 360                                     | 25.4  | 381         | 26.9  | 402         | 28.4  | 423         | 29.8  |
| 360.5                                   | 25.4  | 381.5       | 26.9  | 402.5       | 28.4  | 423.5       | 29.9  |
| 361                                     | 25.5  | 382         | 26.9  | 403         | 28.4  | 424         | 29.9  |
| 361.5                                   | 25.5  | 382.5       | 27.0  | 403.5       | 28.5  | 424.5       | 29.9  |
| 362                                     | 25.5  | 383         | 27.0  | 404         | 28.5  | 425         | 30.0  |
| 362.5                                   | 25.6  | 383.5       | 27.1  | 404.5       | 28.5  | 425.5       | 30.0  |
| 363                                     | 25.6  | 384         | 27.1  | 405         | 28.6  | 426         | 30.1  |
| 363.5                                   | 25.6  | 384.5       | 27.1  | 405.5       | 28.6  | 426.5       | 30.1  |
| 364                                     | 25.7  | 385         | 27.2  | 406         | 28.6  | 427         | 30.1  |
| 364.5                                   | 25.7  | 385.5       | 27.2  | 406.5       | 28.7  | 427.8       | 30.2  |
| 365                                     | 25.7  | 386         | 27.2  | 407         | 28.7  | 428         | 30.2  |
| 365.5                                   | 25.8  | 386.5       | 27.3  | 407.5       | 28.7  | 428.5       | 30.2  |
| 366                                     | 25.8  | 387         | 27.3  | 408         | 28.8  | 429         | 30.3  |
| 366.5                                   | 25.9  | 387.5       | 27.3  | 408.5       | 28.8  | 429.5       | 30.3  |
| 367                                     | 25.9  | 388         | 27.4  | 409         | 28.9  | 430         | 30.3  |
| 367.5                                   | 25.9  | 388.5       | 27.4  | 409.5       | 28.9  | 430.5       | 30.4  |
| 368                                     | 26.0  | 389         | 27.4  | 410         | 28.9  | 431         | 30.4  |
| 368.5                                   | 26.0  | 389.5       | 27.5  | 410.5       | 29.0  | 431.5       | 30.4  |
| 369                                     | 26.0  | 390         | 27.5  | 411         | 29.0  | 432         | 30.5  |
| 369.5                                   | 26.1  | 390.5       | 27.5  | 411.5       | 29.0  | 432.5       | 30.5  |
| 370                                     | 26.1  | 391         | 27.6  | 412         | 29.1  | 433         | 30.5  |
| 370.5                                   | 26.1  | 391.5       | 27.6  | 412.5       | 29.1  | 433.5       | 30.6  |
| 371                                     | 26.2  | 392         | 27.7  | 413         | 29.1  | 434         | 30.6  |
| 371.5                                   | 26.2  | 392.5       | 27.7  | 413.5       | 29.2  | 434.5       | 30.7  |
| 372                                     | 26.2  | 393         | 27.7  | 414         | 29.2  | 435         | 30.7  |
| 372.5                                   | 26.3  | 393.5       | 27.8  | 414.5       | 29.2  | 435.5       | 30.7  |
| 373                                     | 26.3  | 394         | 27.8  | 415         | 29.3  | 436         | 30.8  |
| 373.5                                   | 26.3  | 394.5       | 27.8  | 415.5       | 29.3  | 436.5       | 30.8  |
| 374                                     | 26.4  | 395         | 27.9  | 416         | 29.3  | 437         | 30.8  |
| 374.5                                   | 26.4  | 395.5       | 27.9  | 416.5       | 29.4  | 437.5       | 30.9  |
| 375                                     | 26.5  | 396         | 27.9  | 417         | 29.4  | 438         | 30.9  |
| 375.5                                   | 26.5  | 396.5       | 28.0  | 417.5       | 29.5  | 438.5       | 30.9  |
| 376                                     | 26.5  | 397         | 28.0  | 418         | 29.5  | 439         | 31.0  |
| 376.5                                   | 26.6  | 397.5       | 28.0  | 418.5       | 29.5  | 439.5       | 31.0  |
| 377                                     | 26.6  | 398         | 28.1  | 419         | 29.6  | 440         | 31.0  |
| 377.5                                   | 26.6  | 398.5       | 28.1  | 419.5       | 29.6  | 440.5       | 31.1  |
| 378                                     | 26.7  | 399         | 28.1  | 420         | 29.6  | 441         | 31.1  |
| 378.5                                   | 26.7  | 399.5       | 28.2  | 420.5       | 29.7  | 441.5       | 31.1  |
| 379                                     | 26.7  | 400         | 28.2  | 421         | 29.7  | 442         | 31.2  |
| 379.5                                   | 26.8  | 400.5       | 28.3  | 421.5       | 29.7  | 442.5       | 31.2  |

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| <b>TEST WEIGHT CONVERSION CHART</b>            |       |             |       |             |       |             |       |
|--|-------|-------------|-------|-------------|-------|-------------|-------|
| <b>GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)</b> |       |             |       |             |       |             |       |
| 443 – 463.5                                    |       | 464 – 484.5 |       | 485 – 505.5 |       | 506 – 526.5 |       |
| Grams  | lb/bu | Grams       | lb/bu | Grams       | lb/bu | Grams       | lb/bu |
| 443  | 31.3  | 464         | 32.7  | 485         | 34.2  | 506         | 35.7  |
| 443.5  | 31.3  | 464.5       | 32.8  | 485.5       | 34.3  | 506.5       | 35.7  |
| 444  | 31.3  | 465         | 32.8  | 486         | 34.3  | 507         | 35.8  |
| 444.5  | 31.4  | 465.5       | 32.8  | 486.5       | 34.3  | 507.5       | 35.8  |
| 445  | 31.4  | 466         | 32.9  | 487         | 34.4  | 508         | 35.8  |
| 445.5  | 31.4  | 466.5       | 32.9  | 487.5       | 34.4  | 508.5       | 35.9  |
| 446  | 31.5  | 467         | 32.9  | 488         | 34.4  | 509         | 35.9  |
| 446.5  | 31.5  | 467.5       | 33.0  | 488.5       | 34.5  | 509.5       | 35.9  |
| 447  | 31.5  | 468         | 33.0  | 489         | 34.5  | 510         | 36.0  |
| 447.5  | 31.6  | 468.5       | 33.1  | 489.5       | 34.5  | 510.5       | 36.0  |
| 448  | 31.6  | 469         | 33.1  | 490         | 34.6  | 511         | 36.0  |
| 448.5  | 31.6  | 469.5       | 33.1  | 490.5       | 34.6  | 511.5       | 36.1  |
| 449  | 31.7  | 470         | 33.2  | 491         | 34.6  | 512         | 36.1  |
| 449.5  | 31.7  | 470.5       | 33.2  | 491.5       | 34.7  | 512.5       | 36.2  |
| 450  | 31.7  | 471         | 33.2  | 492         | 34.7  | 513         | 36.2  |
| 450.5  | 31.8  | 471.5       | 33.3  | 492.5       | 34.7  | 513.5       | 36.2  |
| 451  | 31.8  | 472         | 33.3  | 493         | 34.8  | 514         | 36.3  |
| 451.5  | 31.9  | 472.5       | 33.3  | 493.5       | 34.8  | 514.5       | 36.3  |
| 452  | 31.9  | 473         | 33.4  | 494         | 34.9  | 515         | 36.3  |
| 452.5  | 31.9  | 473.5       | 33.4  | 494.5       | 34.9  | 515.5       | 36.4  |
| 453  | 32.0  | 474         | 33.4  | 495         | 34.9  | 516         | 36.4  |
| 453.5  | 32.0  | 474.5       | 33.5  | 495.5       | 35.0  | 516.5       | 36.4  |
| 454  | 32.0  | 475         | 33.5  | 496         | 35.0  | 517         | 36.5  |
| 454.5  | 32.1  | 475.5       | 33.5  | 496.5       | 35.0  | 517.5       | 36.5  |
| 455  | 32.1  | 476         | 33.6  | 497         | 35.1  | 518         | 36.5  |
| 455.5  | 32.1  | 476.5       | 33.6  | 497.5       | 35.1  | 518.5       | 36.6  |
| 456  | 32.2  | 477         | 33.7  | 498         | 35.1  | 519         | 36.6  |
| 456.5  | 32.2  | 477.5       | 33.7  | 498.5       | 35.2  | 519.5       | 36.6  |
| 457  | 32.2  | 478         | 33.7  | 499         | 35.2  | 520         | 36.7  |
| 457.5  | 32.3  | 478.5       | 33.8  | 499.5       | 35.2  | 520.5       | 36.7  |
| 458  | 32.3  | 479         | 33.8  | 500         | 35.3  | 521         | 36.8  |
| 458.5  | 32.3  | 479.5       | 33.8  | 500.5       | 35.3  | 521.5       | 36.8  |
| 459  | 32.4  | 480         | 33.9  | 501         | 35.3  | 522         | 36.8  |
| 459.5  | 32.4  | 480.5       | 33.9  | 501.5       | 35.4  | 522.5       | 36.9  |
| 460  | 32.5  | 481         | 33.9  | 502         | 35.4  | 523         | 36.9  |
| 460.5  | 32.5  | 481.5       | 34.0  | 502.5       | 35.5  | 523.5       | 36.9  |
| 461  | 32.5  | 482         | 34.0  | 503         | 35.5  | 524         | 37.0  |
| 461.5  | 32.6  | 482.5       | 34.0  | 503.5       | 35.5  | 524.5       | 37.0  |
| 462  | 32.6  | 483         | 34.1  | 504         | 35.6  | 525         | 37.0  |
| 462.5  | 32.6  | 483.5       | 34.1  | 504.5       | 35.6  | 525.5       | 37.1  |
| 463  | 32.7  | 484         | 34.1  | 505         | 35.6  | 526         | 37.1  |
| 463.5  | 32.7  | 484.5       | 34.2  | 505.5       | 35.7  | 526.5       | 37.1  |

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| TEST WEIGHT CONVERSION CHART            |       |             |       |             |       |             |       |
|---|-------|-------------|-------|-------------|-------|-------------|-------|
| GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU) |       |             |       |             |       |             |       |
| 527 – 547.5                             |       | 548 – 568.5 |       | 569 – 589.5 |       | 590 – 610.5 |       |
| Grams                                   | lb/bu | Grams       | lb/bu | Grams       | lb/bu | Grams       | lb/bu |
| 527                                     | 37.2  | 548         | 38.7  | 569         | 40.1  | 590         | 41.6  |
| 527.5                                   | 37.2  | 548.5       | 38.7  | 569.5       | 40.2  | 590.5       | 41.7  |
| 528                                     | 37.2  | 549         | 38.7  | 570         | 40.2  | 591         | 41.7  |
| 528.5                                   | 37.3  | 549.5       | 38.8  | 570.5       | 40.2  | 591.5       | 41.7  |
| 529                                     | 37.3  | 550         | 38.8  | 571         | 40.3  | 592         | 41.8  |
| 529.5                                   | 37.4  | 550.5       | 38.8  | 571.5       | 40.3  | 592.5       | 41.8  |
| 530                                     | 37.4  | 551         | 38.9  | 572         | 40.4  | 593         | 41.8  |
| 530.5                                   | 37.4  | 551.5       | 38.9  | 572.5       | 40.4  | 593.5       | 41.9  |
| 531                                     | 37.5  | 552         | 38.9  | 573         | 40.4  | 594         | 41.9  |
| 531.5                                   | 37.5  | 552.5       | 39.0  | 573.5       | 40.5  | 594.5       | 41.9  |
| 532                                     | 37.5  | 553         | 39.0  | 574         | 40.5  | 595         | 42.0  |
| 532.5                                   | 37.6  | 553.5       | 39.0  | 574.5       | 40.5  | 595.5       | 42.0  |
| 533                                     | 37.6  | 554         | 39.1  | 575         | 40.6  | 596         | 42.0  |
| 533.5                                   | 37.6  | 554.5       | 39.1  | 575.5       | 40.6  | 596.5       | 42.1  |
| 534                                     | 37.7  | 555         | 39.2  | 576         | 40.6  | 597         | 42.1  |
| 534.5                                   | 37.7  | 555.5       | 39.2  | 576.5       | 40.7  | 597.5       | 42.2  |
| 535                                     | 37.7  | 556         | 39.2  | 577         | 40.7  | 598         | 42.2  |
| 535.5                                   | 37.8  | 556.5       | 39.3  | 577.5       | 40.7  | 598.5       | 42.2  |
| 536                                     | 37.8  | 557         | 39.3  | 578         | 40.8  | 599         | 42.3  |
| 536.5                                   | 37.8  | 557.5       | 39.3  | 578.5       | 40.8  | 599.5       | 42.3  |
| 537                                     | 37.9  | 558         | 39.4  | 579         | 40.8  | 600         | 42.3  |
| 537.5                                   | 37.9  | 558.5       | 39.4  | 579.5       | 40.9  | 600.5       | 42.4  |
| 538                                     | 38.0  | 559         | 39.4  | 580         | 40.9  | 601         | 42.4  |
| 538.5                                   | 38.0  | 559.5       | 39.5  | 580.5       | 41.0  | 601.5       | 42.4  |
| 539                                     | 38.0  | 560         | 39.5  | 581         | 41.0  | 602         | 42.5  |
| 539.5                                   | 38.1  | 560.5       | 39.5  | 581.5       | 41.0  | 602.5       | 42.5  |
| 540                                     | 38.1  | 561         | 39.6  | 582         | 41.1  | 603         | 42.5  |
| 540.5                                   | 38.1  | 561.5       | 39.6  | 582.5       | 41.1  | 603.5       | 42.6  |
| 541                                     | 38.2  | 562         | 39.6  | 583         | 41.1  | 604         | 42.6  |
| 541.5                                   | 38.2  | 562.5       | 39.7  | 583.5       | 41.2  | 604.5       | 42.6  |
| 542                                     | 38.2  | 563         | 39.7  | 584         | 41.2  | 605         | 42.7  |
| 542.5                                   | 38.3  | 563.5       | 39.8  | 584.5       | 41.2  | 605.5       | 42.7  |
| 543                                     | 38.3  | 564         | 39.8  | 585         | 41.3  | 606         | 42.8  |
| 543.5                                   | 38.3  | 564.5       | 39.8  | 585.5       | 41.3  | 606.5       | 42.8  |
| 544                                     | 38.4  | 565         | 39.9  | 586         | 41.3  | 607         | 42.8  |
| 544.5                                   | 38.4  | 565.5       | 39.9  | 586.5       | 41.4  | 607.5       | 42.9  |
| 545                                     | 38.4  | 566         | 39.9  | 587         | 41.4  | 608         | 42.9  |
| 545.5                                   | 38.5  | 566.5       | 40.0  | 587.5       | 41.4  | 608.5       | 42.9  |
| 546                                     | 38.5  | 567         | 40.0  | 588         | 41.5  | 609         | 43.0  |
| 546.5                                   | 38.6  | 567.5       | 40.0  | 588.5       | 41.5  | 609.5       | 43.0  |
| 547                                     | 38.6  | 568         | 40.1  | 589         | 41.6  | 610         | 43.0  |
| 547.5                                   | 38.6  | 568.5       | 40.1  | 589.5       | 41.6  | 610.5       | 43.1  |

| <b>TEST WEIGHT CONVERSION CHART</b>            |       |             |       |             |       |             |       |
|--|-------|-------------|-------|-------------|-------|-------------|-------|
| <b>GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)</b> |       |             |       |             |       |             |       |
| 611 – 631.5                                    |       | 632 – 652.5 |       | 653 – 673.5 |       | 674 – 694.5 |       |
| Grams  | lb/bu | Grams       | lb/bu | Grams       | lb/bu | Grams       | lb/bu |
| 611  | 43.1  | 632         | 44.6  | 653         | 46.1  | 674         | 47.5  |
| 611.5  | 43.1  | 632.5       | 44.6  | 653.5       | 46.1  | 674.5       | 47.6  |
| 612  | 43.2  | 633         | 44.7  | 654         | 46.1  | 675         | 47.6  |
| 612.5  | 43.2  | 633.5       | 44.7  | 654.5       | 46.2  | 675.5       | 47.7  |
| 613  | 43.2  | 634         | 44.7  | 655         | 46.2  | 676         | 47.7  |
| 613.5  | 43.3  | 634.5       | 44.8  | 655.5       | 46.2  | 676.5       | 47.7  |
| 614  | 43.3  | 635         | 44.8  | 656         | 46.3  | 677         | 47.8  |
| 614.5  | 43.4  | 635.5       | 44.8  | 656.5       | 46.3  | 677.5       | 47.8  |
| 615  | 43.4  | 636         | 44.9  | 657         | 46.3  | 678         | 47.8  |
| 615.5  | 43.4  | 636.5       | 44.9  | 657.5       | 46.4  | 678.5       | 47.9  |
| 616  | 43.5  | 637         | 44.9  | 658         | 46.4  | 679         | 47.9  |
| 616.5  | 43.5  | 637.5       | 45.0  | 658.5       | 46.5  | 679.5       | 47.9  |
| 617  | 43.5  | 638         | 45.0  | 659         | 46.5  | 680         | 48.0  |
| 617.5  | 43.6  | 638.5       | 45.0  | 659.5       | 46.5  | 680.5       | 48.0  |
| 618  | 43.6  | 639         | 45.1  | 660         | 46.6  | 681         | 48.0  |
| 618.5  | 43.6  | 639.5       | 45.1  | 660.5       | 46.6  | 681.5       | 48.1  |
| 619  | 43.7  | 640         | 45.2  | 661         | 46.6  | 682         | 48.1  |
| 619.5  | 43.7  | 640.5       | 45.2  | 661.5       | 46.7  | 682.5       | 48.1  |
| 620  | 43.7  | 641         | 45.2  | 662         | 46.7  | 683         | 48.2  |
| 620.5  | 43.8  | 641.5       | 45.3  | 662.5       | 46.7  | 683.5       | 48.2  |
| 621  | 43.8  | 642         | 45.3  | 663         | 46.8  | 684         | 48.3  |
| 621.5  | 43.8  | 642.5       | 45.3  | 663.5       | 46.8  | 684.5       | 48.3  |
| 622  | 43.9  | 643         | 45.4  | 664         | 46.8  | 685         | 48.3  |
| 622.5  | 43.9  | 643.5       | 45.4  | 664.5       | 46.9  | 685.5       | 48.4  |
| 623  | 44.0  | 644         | 45.4  | 665         | 46.9  | 686         | 48.4  |
| 623.5  | 44.0  | 644.5       | 45.5  | 665.5       | 46.9  | 686.5       | 48.4  |
| 624  | 44.0  | 645         | 45.5  | 666         | 47.0  | 687         | 48.5  |
| 624.5  | 44.1  | 645.5       | 45.5  | 666.5       | 47.0  | 687.5       | 48.5  |
| 625  | 44.1  | 646         | 45.6  | 667         | 47.1  | 688         | 48.5  |
| 625.5  | 44.1  | 646.5       | 45.6  | 667.5       | 47.1  | 688.5       | 48.6  |
| 626  | 44.2  | 647         | 45.6  | 668         | 47.1  | 689         | 48.6  |
| 626.5  | 44.2  | 647.5       | 45.7  | 668.5       | 47.2  | 689.5       | 48.6  |
| 627  | 44.2  | 648         | 45.7  | 669         | 47.2  | 690         | 48.7  |
| 627.5  | 44.3  | 648.5       | 45.8  | 669.5       | 47.2  | 690.5       | 48.7  |
| 628  | 44.3  | 649         | 45.8  | 670         | 47.3  | 691         | 48.7  |
| 628.5  | 44.3  | 649.5       | 45.8  | 670.5       | 47.3  | 691.5       | 48.8  |
| 629  | 44.4  | 650         | 45.9  | 671         | 47.3  | 692         | 48.8  |
| 629.5  | 44.4  | 650.5       | 45.9  | 671.5       | 47.4  | 692.5       | 48.9  |
| 630  | 44.4  | 651         | 45.9  | 672         | 47.4  | 693         | 48.9  |
| 630.5  | 44.5  | 651.5       | 46.0  | 672.5       | 47.4  | 693.5       | 48.9  |
| 631  | 44.5  | 652         | 46.0  | 673         | 47.5  | 694         | 49.0  |
| 631.5  | 44.6  | 652.5       | 46.0  | 673.5       | 47.5  | 694.5       | 49.0  |

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| TEST WEIGHT CONVERSION CHART            |       |             |       |             |       |             |       |
|---|-------|-------------|-------|-------------|-------|-------------|-------|
| GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU) |       |             |       |             |       |             |       |
| 695 – 715.5                             |       | 716 – 736.5 |       | 737 – 757.5 |       | 758 – 778.5 |       |
| Grams                                   | lb/bu | Grams       | lb/bu | Grams       | lb/bu | Grams       | lb/bu |
| 695                                     | 49.0  | 716         | 50.5  | 737         | 52.0  | 758         | 53.5  |
| 695.5                                   | 49.1  | 716.5       | 50.5  | 737.5       | 52.0  | 758.5       | 53.5  |
| 696                                     | 49.1  | 717         | 50.6  | 738         | 52.1  | 759         | 53.5  |
| 696.5                                   | 49.1  | 717.5       | 50.6  | 738.5       | 52.1  | 759.5       | 53.6  |
| 697                                     | 49.2  | 718         | 50.7  | 739         | 52.1  | 760         | 53.6  |
| 697.5                                   | 49.2  | 718.5       | 50.7  | 739.5       | 52.2  | 760.5       | 53.7  |
| 698                                     | 49.2  | 719         | 50.7  | 740         | 52.2  | 761         | 53.7  |
| 698.5                                   | 49.3  | 719.5       | 50.8  | 740.5       | 52.2  | 761.5       | 53.7  |
| 699                                     | 49.3  | 720         | 50.8  | 741         | 52.3  | 762         | 53.8  |
| 699.5                                   | 49.3  | 720.5       | 50.8  | 741.5       | 52.3  | 762.5       | 53.8  |
| 700                                     | 49.4  | 721         | 50.9  | 742         | 52.3  | 763         | 53.8  |
| 700.5                                   | 49.4  | 721.5       | 50.9  | 742.5       | 52.4  | 763.5       | 53.9  |
| 701                                     | 49.5  | 722         | 50.9  | 743         | 52.4  | 764         | 53.9  |
| 701.5                                   | 49.5  | 722.5       | 51.0  | 743.5       | 52.5  | 764.5       | 53.9  |
| 702                                     | 49.5  | 723         | 51.0  | 744         | 52.5  | 765         | 54.0  |
| 702.5                                   | 49.6  | 723.5       | 51.0  | 744.5       | 52.5  | 765.5       | 54.0  |
| 703                                     | 49.6  | 724         | 51.1  | 745         | 52.6  | 766         | 54.0  |
| 703.5                                   | 49.6  | 724.5       | 51.1  | 745.5       | 52.6  | 766.5       | 54.1  |
| 704                                     | 49.7  | 725         | 51.1  | 746         | 52.6  | 767         | 54.1  |
| 704.5                                   | 49.7  | 725.5       | 51.2  | 746.5       | 52.7  | 767.5       | 54.1  |
| 705                                     | 49.7  | 726         | 51.2  | 747         | 52.7  | 768         | 54.2  |
| 705.5                                   | 49.8  | 726.5       | 51.3  | 747.5       | 52.7  | 768.5       | 54.2  |
| 706                                     | 49.8  | 727         | 51.3  | 748         | 52.8  | 769         | 54.3  |
| 706.5                                   | 49.8  | 727.5       | 51.3  | 748.5       | 52.8  | 769.5       | 54.3  |
| 707                                     | 49.9  | 728         | 51.4  | 749         | 52.8  | 770         | 54.3  |
| 707.5                                   | 49.9  | 728.5       | 51.4  | 749.5       | 52.9  | 770.5       | 54.4  |
| 708                                     | 49.9  | 729         | 51.4  | 750         | 52.9  | 771         | 54.4  |
| 708.5                                   | 50.0  | 729.5       | 51.5  | 750.5       | 52.9  | 771.5       | 54.4  |
| 709                                     | 50.0  | 730         | 51.5  | 751         | 53.0  | 772         | 54.5  |
| 709.5                                   | 50.1  | 730.5       | 51.5  | 751.5       | 53.0  | 772.5       | 54.5  |
| 710                                     | 50.1  | 731         | 51.6  | 752         | 53.1  | 773         | 54.5  |
| 710.5                                   | 50.1  | 731.5       | 51.6  | 752.5       | 53.1  | 773.5       | 54.6  |
| 711                                     | 50.2  | 732         | 51.6  | 753         | 53.1  | 774         | 54.6  |
| 711.5                                   | 50.2  | 732.5       | 51.7  | 753.5       | 53.2  | 774.5       | 54.6  |
| 712                                     | 50.2  | 733         | 51.7  | 754         | 53.2  | 775         | 54.7  |
| 712.5                                   | 50.3  | 733.5       | 51.7  | 754.5       | 53.2  | 775.5       | 54.7  |
| 713                                     | 50.3  | 734         | 51.8  | 755         | 53.3  | 776         | 54.7  |
| 713.5                                   | 50.3  | 734.5       | 51.8  | 755.5       | 53.3  | 776.5       | 54.8  |
| 714                                     | 50.4  | 735         | 51.9  | 756         | 53.3  | 777         | 54.8  |
| 714.5                                   | 50.4  | 735.5       | 51.9  | 756.5       | 53.4  | 777.5       | 54.9  |
| 715                                     | 50.4  | 736         | 51.9  | 757         | 53.4  | 778         | 54.9  |
| 715.5                                   | 50.5  | 736.5       | 52.0  | 757.5       | 53.4  | 778.5       | 54.9  |

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| <b>TEST WEIGHT CONVERSION CHART</b>            |       |             |       |             |       |             |       |
|--|-------|-------------|-------|-------------|-------|-------------|-------|
| <b>GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)</b> |       |             |       |             |       |             |       |
| 779 – 799.5                                    |       | 800 – 820.5 |       | 821 – 841.5 |       | 842 – 862.5 |       |
| Grams  | lb/bu | Grams       | lb/bu | Grams       | lb/bu | Grams       | lb/bu |
| 779  | 55.0  | 800         | 56.4  | 821         | 57.9  | 842         | 59.4  |
| 779.5  | 55.0  | 800.5       | 56.5  | 821.5       | 58.0  | 842.5       | 59.4  |
| 780  | 55.0  | 801         | 56.5  | 822         | 58.0  | 843         | 59.5  |
| 780.5  | 55.1  | 801.5       | 56.5  | 822.5       | 58.0  | 843.5       | 59.5  |
| 781  | 55.1  | 802         | 56.6  | 823         | 58.1  | 844         | 59.5  |
| 781.5  | 55.1  | 802.5       | 56.6  | 823.5       | 58.1  | 844.5       | 59.6  |
| 782  | 55.2  | 803         | 56.6  | 824         | 58.1  | 845         | 59.6  |
| 782.5  | 55.2  | 803.5       | 56.7  | 824.5       | 58.2  | 845.5       | 59.6  |
| 783  | 55.2  | 804         | 56.7  | 825         | 58.2  | 846         | 59.7  |
| 783.5  | 55.3  | 804.5       | 56.8  | 825.5       | 58.2  | 846.5       | 59.7  |
| 784  | 55.3  | 805         | 56.8  | 826         | 58.3  | 847         | 59.8  |
| 784.5  | 55.3  | 805.5       | 56.8  | 826.5       | 58.3  | 847.5       | 59.8  |
| 785  | 55.4  | 806         | 56.9  | 827         | 58.3  | 848         | 59.8  |
| 785.5  | 55.4  | 806.5       | 56.9  | 827.5       | 58.4  | 848.5       | 59.9  |
| 786  | 55.5  | 807         | 56.9  | 828         | 58.4  | 849         | 59.9  |
| 786.5  | 55.5  | 807.5       | 57.0  | 828.5       | 58.4  | 849.5       | 59.9  |
| 787  | 55.5  | 808         | 57.0  | 829         | 58.5  | 850         | 60.0  |
| 787.5  | 55.6  | 808.5       | 57.0  | 829.5       | 58.5  | 850.5       | 60.0  |
| 788  | 55.6  | 809         | 57.1  | 830         | 58.6  | 851         | 60.0  |
| 788.5  | 55.6  | 809.5       | 57.1  | 830.5       | 58.6  | 851.5       | 60.1  |
| 789  | 55.7  | 810         | 57.1  | 831         | 58.6  | 852         | 60.1  |
| 789.5  | 55.7  | 810.5       | 57.2  | 831.5       | 58.7  | 852.5       | 60.1  |
| 790  | 55.7  | 811         | 57.2  | 832         | 58.7  | 853         | 60.2  |
| 790.5  | 55.8  | 811.5       | 57.2  | 832.5       | 58.7  | 853.5       | 60.2  |
| 791  | 55.8  | 812         | 57.3  | 833         | 58.8  | 854         | 60.2  |
| 791.5  | 55.8  | 812.5       | 57.3  | 833.5       | 58.8  | 854.5       | 60.3  |
| 792  | 55.9  | 813         | 57.4  | 834         | 58.8  | 855         | 60.3  |
| 792.5  | 55.9  | 813.5       | 57.4  | 834.5       | 58.9  | 855.5       | 60.4  |
| 793  | 55.9  | 814         | 57.4  | 835         | 58.9  | 856         | 60.4  |
| 793.5  | 56.0  | 814.5       | 57.5  | 835.5       | 58.9  | 856.5       | 60.4  |
| 794  | 56.0  | 815         | 57.5  | 836         | 59.0  | 857         | 60.5  |
| 794.5  | 56.1  | 815.5       | 57.5  | 836.5       | 59.0  | 857.5       | 60.5  |
| 795  | 56.1  | 816         | 57.6  | 837         | 59.0  | 858         | 60.5  |
| 795.5  | 56.1  | 816.5       | 57.6  | 837.5       | 59.1  | 858.5       | 60.6  |
| 796  | 56.2  | 817         | 57.6  | 838         | 59.1  | 859         | 60.6  |
| 796.5  | 56.2  | 817.5       | 57.7  | 838.5       | 59.2  | 859.5       | 60.6  |
| 797  | 56.2  | 818         | 57.7  | 839         | 59.2  | 860         | 60.7  |
| 797.5  | 56.3  | 818.5       | 57.7  | 839.5       | 59.2  | 860.5       | 60.7  |
| 798  | 56.3  | 819         | 57.8  | 840         | 59.3  | 861         | 60.7  |
| 798.5  | 56.3  | 819.5       | 57.8  | 840.5       | 59.3  | 861.5       | 60.8  |
| 799  | 56.4  | 820         | 57.8  | 841         | 59.3  | 862         | 60.8  |
| 799.5  | 56.4  | 820.5       | 57.9  | 841.5       | 59.4  | 862.5       | 60.8  |

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| TEST WEIGHT CONVERSION CHART            |       |             |       |             |       |             |       |
|---|-------|-------------|-------|-------------|-------|-------------|-------|
| GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU) |       |             |       |             |       |             |       |
| 863 – 880.5                             |       | 881 - 898.5 |       | 899 – 916.5 |       | 917 – 934.5 |       |
| Grams                                   | lb/bu | Grams       | lb/bu | Grams       | lb/bu | Grams       | lb/bu |
| 863                                     | 60.9  | 881         | 62.2  | 899         | 63.4  | 917         | 64.7  |
| 863.5                                   | 60.9  | 881.5       | 62.2  | 899.5       | 63.5  | 917.5       | 64.7  |
| 864                                     | 61.0  | 882         | 62.2  | 900         | 63.5  | 918         | 64.8  |
| 864.5                                   | 61.0  | 882.5       | 62.3  | 900.5       | 63.5  | 918.5       | 64.8  |
| 865                                     | 61.0  | 883         | 62.3  | 901         | 63.6  | 919         | 64.8  |
| 865.5                                   | 61.1  | 883.5       | 62.3  | 901.5       | 63.6  | 919.5       | 64.9  |
| 866                                     | 61.1  | 884         | 62.4  | 902         | 63.6  | 920         | 64.9  |
| 866.5                                   | 61.1  | 884.5       | 62.4  | 902.5       | 63.7  | 920.5       | 64.9  |
| 867                                     | 61.2  | 885         | 62.4  | 903         | 63.7  | 921         | 65.0  |
| 867.5                                   | 61.2  | 885.5       | 62.5  | 903.5       | 63.7  | 921.5       | 65.0  |
| 868                                     | 61.2  | 886         | 62.5  | 904         | 63.8  | 922         | 65.0  |
| 868.5                                   | 61.3  | 886.5       | 62.5  | 904.5       | 63.8  | 922.5       | 65.1  |
| 869                                     | 61.3  | 887         | 62.6  | 905         | 63.8  | 923         | 65.1  |
| 869.5                                   | 61.3  | 887.5       | 62.6  | 905.5       | 63.9  | 923.5       | 65.2  |
| 870                                     | 61.4  | 888         | 62.6  | 906         | 63.9  | 924         | 65.2  |
| 870.5                                   | 61.4  | 888.5       | 62.7  | 906.5       | 64.0  | 924.5       | 65.2  |
| 871                                     | 61.4  | 889         | 62.7  | 907         | 64.0  | 925         | 65.3  |
| 871.5                                   | 61.5  | 889.5       | 62.8  | 907.5       | 64.0  | 925.5       | 65.3  |
| 872                                     | 61.5  | 890         | 62.8  | 908         | 64.1  | 926         | 65.3  |
| 872.5                                   | 61.6  | 890.5       | 62.8  | 908.5       | 64.1  | 926.5       | 65.4  |
| 873                                     | 61.6  | 891         | 62.9  | 909         | 64.1  | 927         | 65.4  |
| 873.5                                   | 61.6  | 891.5       | 62.9  | 909.5       | 64.2  | 927.5       | 65.4  |
| 874                                     | 61.7  | 892         | 62.9  | 910         | 64.2  | 928         | 65.5  |
| 874.5                                   | 61.7  | 892.5       | 63.0  | 910.5       | 64.2  | 928.5       | 65.5  |
| 875                                     | 61.7  | 893         | 63.0  | 911         | 64.3  | 929         | 65.5  |
| 875.5                                   | 61.8  | 893.5       | 63.0  | 911.5       | 64.3  | 929.5       | 65.6  |
| 876                                     | 61.8  | 894         | 63.1  | 912         | 64.3  | 930         | 65.6  |
| 876.5                                   | 61.8  | 894.5       | 63.1  | 912.5       | 64.4  | 930.5       | 65.6  |
| 877                                     | 61.9  | 895         | 63.1  | 913         | 64.4  | 931         | 65.7  |
| 877.5                                   | 61.9  | 895.5       | 63.2  | 913.5       | 64.4  | 931.5       | 65.7  |
| 878                                     | 61.9  | 896         | 63.2  | 914         | 64.5  | 932         | 65.8  |
| 878.5                                   | 62.0  | 896.5       | 63.2  | 914.5       | 64.5  | 932.5       | 65.8  |
| 879                                     | 62.0  | 897         | 63.3  | 915         | 64.6  | 933         | 65.8  |
| 879.5                                   | 62.0  | 897.5       | 63.3  | 915.5       | 64.6  | 933.5       | 65.9  |
| 880                                     | 62.1  | 898         | 63.4  | 916         | 64.6  | 934         | 65.9  |
| 880.5                                   | 62.1  | 898.5       | 63.4  | 916.5       | 64.7  | 934.5       | 65.9  |

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| <b>TEST WEIGHT/KILOGRAMS PER HECTOLITER CONVERSION CHART - WHEAT</b> |                         |                         |       |                         |                         |       |                         |                         |
|--|-------------------------|-------------------------|-------|-------------------------|-------------------------|-------|-------------------------|-------------------------|
| lb/bu  | kg/hl<br>Durum<br>Wheat | kg/hl<br>Other<br>Wheat | lb/bu | kg/hl<br>Durum<br>Wheat | kg/hl<br>Other<br>Wheat | lb/bu | kg/hl<br>Durum<br>Wheat | kg/hl<br>Other<br>Wheat |
| 50.0   | 65.2                    | 66.0                    | 54.4  | 70.9                    | 71.7                    | 58.8  | 76.6                    | 77.4                    |
| 50.1   | 65.4                    | 66.1                    | 54.5  | 71.0                    | 71.8                    | 58.9  | 76.7                    | 77.5                    |
| 50.2   | 65.5                    | 66.3                    | 54.6  | 71.2                    | 72.0                    | 59.0  | 76.9                    | 77.6                    |
| 50.3   | 65.6                    | 66.4                    | 54.7  | 71.3                    | 72.1                    | 59.1  | 77.0                    | 77.8                    |
| 50.4   | 65.7                    | 66.5                    | 54.8  | 71.4                    | 72.2                    | 59.2  | 77.1                    | 77.9                    |
| 50.5   | 65.9                    | 66.7                    | 54.9  | 71.6                    | 72.3                    | 59.3  | 77.2                    | 78.0                    |
| 50.6   | 66.0                    | 66.8                    | 55.0  | 71.7                    | 72.5                    | 59.4  | 77.4                    | 78.2                    |
| 50.7   | 66.1                    | 66.9                    | 55.1  | 71.8                    | 72.6                    | 59.5  | 77.5                    | 78.3                    |
| 50.8   | 66.3                    | 67.1                    | 55.2  | 71.9                    | 72.7                    | 59.6  | 77.6                    | 78.4                    |
| 50.9   | 66.4                    | 67.2                    | 55.3  | 72.1                    | 72.9                    | 59.7  | 77.8                    | 78.6                    |
| 51.0   | 66.5                    | 67.3                    | 55.4  | 72.2                    | 73.0                    | 59.8  | 77.9                    | 78.7                    |
| 51.1   | 66.7                    | 67.4                    | 55.5  | 72.3                    | 73.1                    | 59.9  | 78.0                    | 78.8                    |
| 51.2   | 66.8                    | 67.6                    | 55.6  | 72.5                    | 73.3                    | 60.0  | 78.2                    | 78.9                    |
| 51.3   | 66.9                    | 67.7                    | 55.7  | 72.6                    | 73.4                    | 60.1  | 78.3                    | 79.1                    |
| 51.4   | 67.0                    | 67.8                    | 55.8  | 72.7                    | 73.5                    | 60.2  | 78.4                    | 79.2                    |
| 51.5   | 67.2                    | 68.0                    | 55.9  | 72.9                    | 73.6                    | 60.3  | 78.5                    | 79.3                    |
| 51.6   | 67.3                    | 68.1                    | 56.0  | 73.0                    | 73.8                    | 60.4  | 78.7                    | 79.5                    |
| 51.7   | 67.4                    | 68.2                    | 56.1  | 73.1                    | 73.9                    | 60.5  | 78.8                    | 79.6                    |
| 51.8   | 67.6                    | 68.3                    | 56.2  | 73.2                    | 74.0                    | 60.6  | 78.9                    | 79.7                    |
| 51.9   | 67.7                    | 68.5                    | 56.3  | 73.4                    | 74.2                    | 60.7  | 79.1                    | 79.8                    |
| 52.0   | 67.8                    | 68.6                    | 56.4  | 73.5                    | 74.3                    | 60.8  | 79.2                    | 80.0                    |
| 52.1   | 67.9                    | 68.7                    | 56.5  | 73.6                    | 74.4                    | 60.9  | 79.3                    | 80.1                    |
| 52.2   | 68.1                    | 68.9                    | 56.6  | 73.8                    | 74.5                    | 61.0  | 79.4                    | 80.2                    |
| 52.3   | 68.2                    | 69.0                    | 56.7  | 73.9                    | 74.7                    | 61.1  | 79.6                    | 80.4                    |
| 52.4   | 68.3                    | 69.1                    | 56.8  | 74.0                    | 74.8                    | 61.2  | 79.7                    | 80.5                    |
| 52.5   | 68.5                    | 69.2                    | 56.9  | 74.1                    | 74.9                    | 61.3  | 79.8                    | 80.6                    |
| 52.6   | 68.6                    | 69.4                    | 57.0  | 74.3                    | 75.1                    | 61.4  | 80.0                    | 80.7                    |
| 52.7   | 68.7                    | 69.5                    | 57.1  | 74.4                    | 75.2                    | 61.5  | 80.1                    | 80.9                    |
| 52.8   | 68.8                    | 69.6                    | 57.2  | 74.5                    | 75.3                    | 61.6  | 80.2                    | 81.0                    |
| 52.9   | 69.0                    | 69.8                    | 57.3  | 74.7                    | 75.5                    | 61.7  | 80.3                    | 81.1                    |
| 53.0   | 69.1                    | 69.9                    | 57.4  | 74.8                    | 75.6                    | 61.8  | 80.5                    | 81.3                    |
| 53.1   | 69.2                    | 70.0                    | 57.5  | 74.9                    | 75.7                    | 61.9  | 80.6                    | 81.4                    |
| 53.2   | 69.4                    | 70.2                    | 57.6  | 75.0                    | 75.8                    | 62.0  | 80.7                    | 81.5                    |
| 53.3   | 69.5                    | 70.3                    | 57.7  | 75.2                    | 76.0                    | 62.1  | 80.9                    | 81.7                    |
| 53.4   | 69.6                    | 70.4                    | 57.8  | 75.3                    | 76.1                    | 62.2  | 81.0                    | 81.8                    |
| 53.5   | 69.8                    | 70.5                    | 57.9  | 75.4                    | 76.2                    | 62.3  | 81.1                    | 81.9                    |
| 53.6   | 69.9                    | 70.7                    | 58.0  | 75.6                    | 76.4                    | 62.4  | 81.3                    | 82.0                    |
| 53.7   | 70.0                    | 70.8                    | 58.1  | 75.7                    | 76.5                    | 62.5  | 81.4                    | 82.2                    |
| 53.8   | 70.1                    | 70.9                    | 58.2  | 75.8                    | 76.6                    | 62.6  | 81.5                    | 82.3                    |
| 53.9   | 70.3                    | 71.1                    | 58.3  | 76.0                    | 76.7                    | 62.7  | 81.6                    | 82.4                    |
| 54.0   | 70.4                    | 71.2                    | 58.4  | 76.1                    | 76.9                    | 62.8  | 81.8                    | 82.6                    |
| 54.1   | 70.5                    | 71.3                    | 58.5  | 76.2                    | 77.0                    | 62.9  | 81.9                    | 82.7                    |
| 54.2   | 70.7                    | 71.4                    | 58.6  | 76.3                    | 77.1                    | 63.0  | 82.0                    | 82.8                    |
| 54.3   | 70.8                    | 71.6                    | 58.7  | 76.5                    | 77.3                    | 63.1  | 82.2                    | 82.9                    |

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| <b>TEST WEIGHT/KILOGRAMS PER HECTOLITER CONVERSION CHART<br/>OTHER GRAINS</b> |       |       |       |       |       |       |       |       |       |       |       |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| lb/bu   | kg/hl | lb/bu | kg/hl | lb/bu | kg/hl | lb/bu | kg/hl | lb/bu | kg/hl | lb/bu | kg/hl |
| 23.0  | 29.6  | 27.4  | 35.3  | 31.8  | 40.9  | 36.2  | 46.6  | 40.6  | 52.3  | 45.0  | 57.9  |
| 23.1  | 29.7  | 27.5  | 35.4  | 31.9  | 41.1  | 36.3  | 46.7  | 40.7  | 52.4  | 45.1  | 58.0  |
| 23.2  | 29.9  | 27.6  | 35.5  | 32.0  | 41.2  | 36.4  | 46.8  | 40.8  | 52.5  | 45.2  | 58.2  |
| 23.3  | 30.0  | 27.7  | 35.6  | 32.1  | 41.3  | 36.5  | 47.0  | 40.9  | 52.6  | 45.3  | 58.3  |
| 23.4  | 30.1  | 27.8  | 35.8  | 32.2  | 41.4  | 36.6  | 47.1  | 41.0  | 52.8  | 45.4  | 58.4  |
| 23.5  | 30.2  | 27.9  | 35.9  | 32.3  | 41.6  | 36.7  | 47.2  | 41.1  | 52.9  | 45.5  | 58.6  |
| 23.6  | 30.4  | 28.0  | 36.0  | 32.4  | 41.7  | 36.8  | 47.4  | 41.2  | 53.0  | 45.6  | 58.7  |
| 23.7  | 30.5  | 28.1  | 36.2  | 32.5  | 41.8  | 36.9  | 47.5  | 41.3  | 53.2  | 45.7  | 58.8  |
| 23.8  | 30.6  | 28.2  | 36.3  | 32.6  | 42.0  | 37.0  | 47.6  | 41.4  | 53.3  | 45.8  | 58.9  |
| 23.9  | 30.8  | 28.3  | 36.4  | 32.7  | 42.1  | 37.1  | 47.7  | 41.5  | 53.4  | 45.9  | 59.1  |
| 24.0  | 30.9  | 28.4  | 36.6  | 32.8  | 42.2  | 37.2  | 47.9  | 41.6  | 53.5  | 46.0  | 59.2  |
| 24.1  | 31.0  | 28.5  | 36.7  | 32.9  | 42.3  | 37.3  | 48.0  | 41.7  | 53.7  | 46.1  | 59.3  |
| 24.2  | 31.1  | 28.6  | 36.8  | 33.0  | 42.5  | 37.4  | 48.1  | 41.8  | 53.8  | 46.2  | 59.5  |
| 24.3  | 31.3  | 28.7  | 36.9  | 33.1  | 42.6  | 37.5  | 48.3  | 41.9  | 53.9  | 46.3  | 59.6  |
| 24.4  | 31.4  | 28.8  | 37.1  | 33.2  | 42.7  | 37.6  | 48.4  | 42.0  | 54.1  | 46.4  | 59.7  |
| 24.5  | 31.5  | 28.9  | 37.2  | 33.3  | 42.9  | 37.7  | 48.5  | 42.1  | 54.2  | 46.5  | 59.8  |
| 24.6  | 31.7  | 29.0  | 37.3  | 33.4  | 43.0  | 37.8  | 48.6  | 42.2  | 54.3  | 46.6  | 60.0  |
| 24.7  | 31.8  | 29.1  | 37.5  | 33.5  | 43.1  | 37.9  | 48.8  | 42.3  | 54.4  | 46.7  | 60.1  |
| 24.8  | 31.9  | 29.2  | 37.6  | 33.6  | 43.2  | 38.0  | 48.9  | 42.4  | 54.6  | 46.8  | 60.2  |
| 24.9  | 32.0  | 29.3  | 37.7  | 33.7  | 43.4  | 38.1  | 49.0  | 42.5  | 54.7  | 46.9  | 60.4  |
| 25.0  | 32.2  | 29.4  | 37.8  | 33.8  | 43.5  | 38.2  | 49.2  | 42.6  | 54.8  | 47.0  | 60.5  |
| 25.1  | 32.3  | 29.5  | 38.0  | 33.9  | 43.6  | 38.3  | 49.3  | 42.7  | 55.0  | 47.1  | 60.6  |
| 25.2  | 32.4  | 29.6  | 38.1  | 34.0  | 43.8  | 38.4  | 49.4  | 42.8  | 55.1  | 47.2  | 60.7  |
| 25.3  | 32.6  | 29.7  | 38.2  | 34.1  | 43.9  | 38.5  | 49.5  | 42.9  | 55.2  | 47.3  | 60.9  |
| 25.4  | 32.7  | 29.8  | 38.4  | 34.2  | 44.0  | 38.6  | 49.7  | 43.0  | 55.3  | 47.4  | 61.0  |
| 25.5  | 32.8  | 29.9  | 38.5  | 34.3  | 44.1  | 38.7  | 49.8  | 43.1  | 55.5  | 47.5  | 61.1  |
| 25.6  | 32.9  | 30.0  | 38.6  | 34.4  | 44.3  | 38.8  | 49.9  | 43.2  | 55.6  | 47.6  | 61.3  |
| 25.7  | 33.1  | 30.1  | 38.7  | 34.5  | 44.4  | 38.9  | 50.1  | 43.3  | 55.7  | 47.7  | 61.4  |
| 25.8  | 33.2  | 30.2  | 38.9  | 34.6  | 44.5  | 39.0  | 50.2  | 43.4  | 55.9  | 47.8  | 61.5  |
| 25.9  | 33.3  | 30.3  | 39.0  | 34.7  | 44.7  | 39.1  | 50.3  | 43.5  | 56.0  | 47.9  | 61.6  |
| 26.0  | 33.5  | 30.4  | 39.1  | 34.8  | 44.8  | 39.2  | 50.5  | 43.6  | 56.1  | 48.0  | 61.8  |
| 26.1  | 33.6  | 30.5  | 39.3  | 34.9  | 44.9  | 39.3  | 50.6  | 43.7  | 56.2  | 48.1  | 61.9  |
| 26.2  | 33.7  | 30.6  | 39.4  | 35.0  | 45.0  | 39.4  | 50.7  | 43.8  | 56.4  | 48.2  | 62.0  |
| 26.3  | 33.8  | 30.7  | 39.5  | 35.1  | 45.2  | 39.5  | 50.8  | 43.9  | 56.5  | 48.3  | 62.2  |
| 26.4  | 34.0  | 30.8  | 39.6  | 35.2  | 45.3  | 39.6  | 51.0  | 44.0  | 56.6  | 48.4  | 62.3  |
| 26.5  | 34.1  | 30.9  | 39.8  | 35.3  | 45.4  | 39.7  | 51.1  | 44.1  | 56.8  | 48.5  | 62.4  |
| 26.6  | 34.2  | 31.0  | 39.9  | 35.4  | 45.6  | 39.8  | 51.2  | 44.2  | 56.9  | 48.6  | 62.5  |
| 26.7  | 34.4  | 31.1  | 40.0  | 35.5  | 45.7  | 39.9  | 51.4  | 44.3  | 57.0  | 48.7  | 62.7  |
| 26.8  | 34.5  | 31.2  | 40.2  | 35.6  | 45.8  | 40.0  | 51.5  | 44.4  | 57.1  | 48.8  | 62.8  |
| 26.9  | 34.6  | 31.3  | 40.3  | 35.7  | 45.9  | 40.1  | 51.6  | 44.5  | 57.3  | 48.9  | 62.9  |
| 27.0  | 34.7  | 31.4  | 40.4  | 35.8  | 46.1  | 40.2  | 51.7  | 44.6  | 57.4  | 49.0  | 63.1  |
| 27.1  | 34.9  | 31.5  | 40.5  | 35.9  | 46.2  | 40.3  | 51.9  | 44.7  | 57.5  | 49.1  | 63.2  |
| 27.2  | 35.0  | 31.6  | 40.7  | 36.0  | 46.3  | 40.4  | 52.0  | 44.8  | 57.7  | 49.2  | 63.3  |
| 27.3  | 35.1  | 31.7  | 40.8  | 36.1  | 46.5  | 40.5  | 52.1  | 44.9  | 57.8  | 49.3  | 63.4  |

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| <b>TEST WEIGHT/KILOGRAMS PER HECTOLITER CONVERSION CHART<br/>OTHER GRAINS</b> |       |       |       |       |       |       |       |       |       |       |       |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| lb/bu   | kg/hl | lb/bu | kg/hl | lb/bu | kg/hl | lb/bu | kg/hl | lb/bu | kg/hl | lb/bu | kg/hl |
| 49.4  | 63.6  | 51.2  | 65.9  | 53.0  | 68.2  | 54.8  | 70.5  | 56.6  | 72.8  | 58.4  | 75.2  |
| 49.5  | 63.7  | 51.3  | 66.0  | 53.1  | 68.3  | 54.9  | 70.7  | 56.7  | 73.0  | 58.5  | 75.3  |
| 49.6  | 63.8  | 51.4  | 66.2  | 53.2  | 68.5  | 55.0  | 70.8  | 56.8  | 73.1  | 58.6  | 75.4  |
| 49.7  | 64.0  | 51.5  | 66.3  | 53.3  | 68.6  | 55.1  | 70.9  | 56.9  | 73.2  | 58.7  | 75.5  |
| 49.8  | 64.1  | 51.6  | 66.4  | 53.4  | 68.7  | 55.2  | 71.0  | 57.0  | 73.4  | 58.8  | 75.7  |
| 49.9  | 64.2  | 51.7  | 66.5  | 53.5  | 68.9  | 55.3  | 71.2  | 57.1  | 73.5  | 58.9  | 75.8  |
| 50.0  | 64.4  | 51.8  | 66.7  | 53.6  | 69.0  | 55.4  | 71.3  | 57.2  | 73.6  | 59.0  | 75.9  |
| 50.1  | 64.5  | 51.9  | 66.8  | 53.7  | 69.1  | 55.5  | 71.4  | 57.3  | 73.7  | 59.1  | 76.1  |
| 50.2  | 64.6  | 52.0  | 66.9  | 53.8  | 69.2  | 55.6  | 71.6  | 57.4  | 73.9  | 59.2  | 76.2  |
| 50.3  | 64.7  | 52.1  | 67.1  | 53.9  | 69.4  | 55.7  | 71.7  | 57.5  | 74.0  | 59.3  | 76.3  |
| 50.4  | 64.9  | 52.2  | 67.2  | 54.0  | 69.5  | 55.8  | 71.8  | 57.6  | 74.1  | 59.4  | 76.4  |
| 50.5  | 65.0  | 52.3  | 67.3  | 54.1  | 69.6  | 55.9  | 71.9  | 57.7  | 74.3  | 59.5  | 76.6  |
| 50.6  | 65.1  | 52.4  | 67.4  | 54.2  | 69.8  | 56.0  | 72.1  | 57.8  | 74.4  | 59.6  | 76.7  |
| 50.7  | 65.3  | 52.5  | 67.6  | 54.3  | 69.9  | 56.1  | 72.2  | 57.9  | 74.5  | 59.7  | 76.8  |
| 50.8  | 65.4  | 52.6  | 67.7  | 54.4  | 70.0  | 56.2  | 72.3  | 58.0  | 74.6  | 59.8  | 77.0  |
| 50.9  | 65.5  | 52.7  | 67.8  | 54.5  | 70.1  | 56.3  | 72.5  | 58.1  | 74.8  | 59.9  | 77.1  |
| 51.0  | 65.6  | 52.8  | 68.0  | 54.6  | 70.3  | 56.4  | 72.6  | 58.2  | 74.9  | 60.0  | 77.2  |
| 51.1  | 65.8  | 52.9  | 68.1  | 54.7  | 70.4  | 56.5  | 72.7  | 58.3  | 75.0  |       |       |